E-SIKSHA: DISTANCE EDUCATION TOOL

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A Thesis

Presented to the

Faculty of

San Diego State University

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In Partial Fulfillment

of the Requirements for the Degree

Master of Science

in

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by

Digvijay Singh

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SAN DIEGO STATE UNIVERSITY

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DEDICATION

This thesis is dedicated to my parents Mr. Narveer Singh and Mrs. Ritu Singh who always provided me the support and encouragement to do better, throughout the development of this project. I appreciate their support as I would have not made it this far without their inspiration.

ABSTRACT OF THE THESIS

E-siksha: Distance Education Tool
by
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Master of Science in Computer Science
San Diego State University, 2012

The need of education in today's world is immensely required and the so is the need of resources. The use of technology in the field of education would help people gain outmost knowledge from the most knowledgeable people present on earth. Distance is the key which is holding people from across the world to share knowledge. Distance learning tool helps the education system of the world to narrow down the edges present in the education system esp. those present because of long distance.

The paper seeks to address the distance learning methodology which is now growing fast but not fast enough to be used practically everywhere. The thesis is focused on the implementation of e-siksha, a distance education tool which would help student and teachers all around the world to use a common platform available for free. This tool can be used by any teacher and students. The students however would not be required to use the application instead would be using the e-siksha blog page on the internet. The teachers would have access to both the application and website. No registration is required to gain access to already recorded session, as the idea of e-siksha is to spread education for free.

This thesis proposes a successful approach for a tool which can be used by teachers and students to initiate class anywhere in the world and thus can be accessed by any student present anywhere in the world. The classes can be accessed by using any multimedia device such as laptops, computers, Phone or tablets.

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LIST OF ABBREVIATIONS

HTTP	Hypertext Transfer Protocol
RTMP	Real Time Messaging Protocol
XAMPP	X-OS, Apache, Mysql, Php, Perl
JVM	Java Virtual Machine
JMF	Java Media Framework
JWPC	JW Player Control
CSS	Cascading Style Sheets
HTML	Hyper Text Markup Language
W3C	World Wide Web Consortium
XML	Extensible Mark Up Language

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Only living organisms have a propensity to grow, but visualizing the speed at which technology is growing is incalculable. This is not the best part! The best part is - It is not a living organism and yet it grows every year, every month, every day, every hour, every second.

The paper seeks to address the distance learning methodology which is now growing fast but not fast enough to be used practically everywhere. Every coin has two sides and so do the technology and even the age-old driven traditional classroom learning. Discussing the weakness and strength of distance learning is left for future discussion, but moving ahead without providing a space for the real power of distance learning would be a serious omission to this paper.

Think about it: Have you ever thought if you were not sitting here on a 1.5 X 1.2 bench in a 20 X 15 class room rather sitting under the sun on the beach or on a couch at your home or a dinner place in some other city and still getting access to this class you are in, hearing every single word straight from the professors mind, able to see all the presentation slides as the professor goes through them? May I also ask professors if they have ever thought of skipping a class because there is an important meeting they have to attend, Or perhaps because of the environmental conditions or involvement in other projects, they may want to postpone class for some later time but feel they cant because students might not be willing to come after that specific period?

This is just an example where a program which can make this above mentioned flexible classroom concept a desired outcome. Distance Learning is an answer for the above mentioned problems which face not only domestic students but also international students. Many students today are opting for exchange programs to other countries and universities for gaining knowledge from some specialized courses in specific university. While some students can make it through but still there are students who are capable enough to provide

loopholes in great theories but do not have the appurtenances to help them achieve it. The idea here is to bring in a platform, a medium – Distance Learning - through which those students can make their names to the list of THE GREAT IDIOTS WHO CHANGED THE WORLD.

1.2 Background and Motivation

Gone are the days when students had to be present in the class in order to gain access to the professor's lecture on a particular topic. Now, with the involvement of technology in the education system, the students can gain access to possibly every single content item provided by a professor in class, even if they are not physically present in the classroom. Professors also need not be personally present in the class for providing solutions, giving the feedbacks and taping and/or conducting take lessons while they are sitting in a lab or anywhere in the world.

1.2.1 The Problem

On average there are more than ten students in a class and sometimes due to valid circumstances they do miss some of the key lectures. The professors are human beings, and there are times when even they have to either skip the class or cancel it.

Student sitting in a class are coming from different backgrounds, entirely different cultural areas, and some do find it hard understanding the subject because of accent. International students coming for exchange programs or regular courses have a 'how to access this class' fear even though they were exchanging emails with the professor of the class just 15 minutes ago.

Fear of asking a question in a class full of students in common in students as they fear others will make fun of them. I don't know what this phobia is called but my concern here is not about the phobia it's about the fact that students still have this complex in there mind of saving their eminence.

Another question to ask here would be, if you are not living in university dorm how much time does it take for you to reach a class? Modifying the same question, how much time do you spend on road usually to reach a class?

A solution is needed, a medium has to be provided, a table has to be placed in front of all the students/professors who are facing one of the above mentioned problems, where they can talk freely, they can express there views more clearly. Briefly defining a place where the whole class can gather together at a single place for discussions, lectures and everything else a student or a professor can do in a class without being physically present in the class rather attending it either from their dorm rooms or from a different part of a world.

1.2.2 The Proficiency

Search ‘distance learning software’ on the internet and you would end up finding a bunch of different software-application’s present in market which can be adapted for the education system. I have used the word adapted because they are not actually created for educational purposes. They are created for people in the industry to have meetings and to engage in additional training, etc. Adapting or molding an existing tool for personal use is one strategy, but it won’t deliver 100% of what is expected. So it is with repurposing these tools for educational services. Mean appropriate analogy might be when the base of a building is designed to build a twelve floor rectangular building and then attempt to use the same base to build an oval shaped building. The tools available in the market are either only appropriately designed for office\or industry use and not in schools. The few available either are badly designed or with too complex user interface (UI) that the professors and students alike would have to enroll in a class first to understand programmatic features before they could properly use it. Licensed copies industrial grade software is also clearly out of the reach of most academic institutions and their students and teachers.

1.3 THE SOLE

First and the most important point about this project is that it is not designed for office or industry use. It is exclusively created for the academic environment and educational purposes.

The second most important feature of this software is that it is free.

The third point to note here is that there is nothing to download. It is all on the cloud and the list of its unique properties is long for example Audio, Video, Recording, Sharing etc.

The feature case of the product satisfactorily provides the complete look and feel of a real class room, except you are not present in the class room. The product would be having similar functionality but incorporating some new technology does make this product stand apart from others. The unique functionalities, features, requirements of the product and the cutting edge technology used to create this project involved many one-to-one/group discussions and surveys.

This is a product that any student can use to interact with his teacher or his fellow classmates even though they are not in the country. The idea for the product that came out after all these discussions, surveys and group discussions was revolutionary in that it evolved from listening to practitioners in the field who had a stake in seeing the product to be completed. Any success as a product that the learning software might have is directly attributable to its usefulness to these populations of users.

CHAPTER 2

RESEARCH

2.1 THE CONCEPTUAL THEORY

The involvement of technology in every possible field has changed the way a human used to think back in 50's. Technological advancement in the field of education has grown tremendously from the past few years and is rapidly growing. The art is not only to see the growth of technology but to be a part of it and contribute to the field in any small or large advancement in technology. The idea behind e-siksha is to provide education to everyone sitting in any part of any country as mentioned in Figure2.1.

For implementing a tool for distance education, we need to have couple of features embedded in the tool, which can actually make the distance education work. With distance education, It is meant that the teacher and the students are not physically present in front of each other. Thinking about what we would need to implement a class, where the teacher and students are not physically present, Some of the most important questions which step up once we think for implementing the tool are:

- Is it possible to view the professor
- Is it possible to have read only access to professor's computer screen
- Availability of text chat

These are some of the major questions which need to be answered in the tool, so that at least the basic tool is ready. Later we can work on the stability and performance issues of the tool also. We can upgrade the tool to another level by adding number of different features which can be used for implementing a tool for distance education.

We have to make sure every time that we are building a tool for the education system.

Most of the tools presented in the market place are not available for education purposes. Although they could be used for education purposes but the look and feel and the features which are required for the tool to be a part of education system are not available in them.

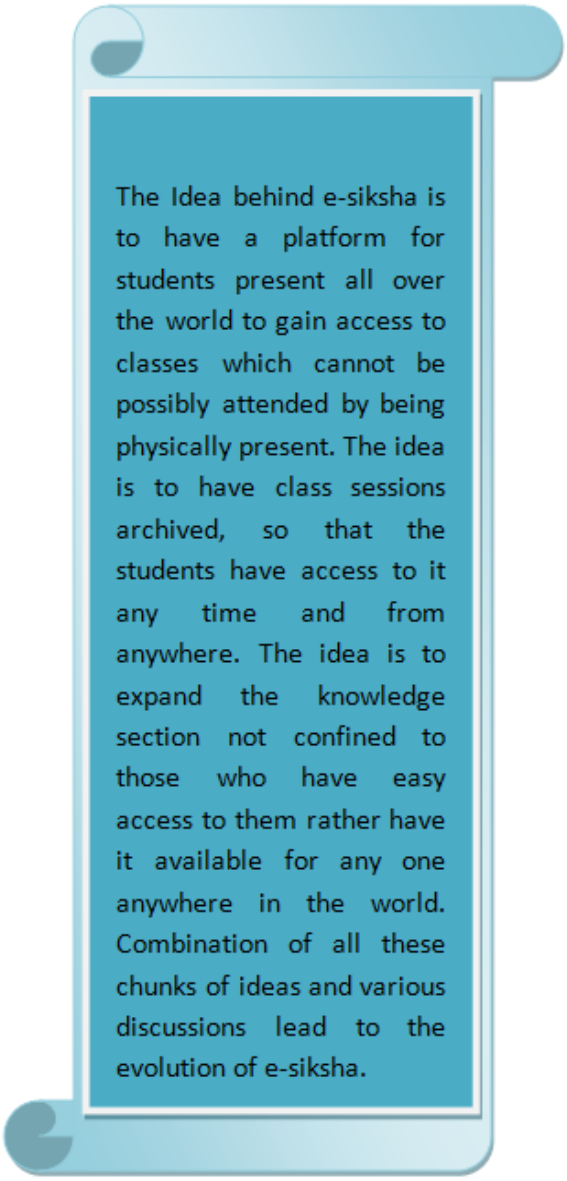

The Idea behind e-siksha is to have a platform for students present all over the world to gain access to classes which cannot be possibly attended by being physically present. The idea is to have class sessions archived, so that the students have access to it any time and from anywhere. The idea is to expand the knowledge section not confined to those who have easy access to them rather have it available for any one anywhere in the world. Combination of all these chunks of ideas and various discussions lead to the evolution of e-siksha.

Figure 2.1. The idea behind e-siksha.

2.2 MARKET RESEARCH

Extensive research was done on the tools which could be used for education purposes and which can actually fulfill the purpose of educating the students while not being physically present there. Choosing for video conferencing tool can be the best fit for our needs; however, we would have to look for certain key features in video conferencing solutions, which are:

- Screen sharing

- Allowing certain number of participants
- Facilitating text chatting
- Recording sessions
- Capturing audio and video via webcam
- Delivering web based programs
- Class authentication

A Market research is done to look for some of the most popular tools present in the market place with the above mentioned features and, which can be used extensively by the education system. Some of the most known and useable tools (not necessarily being currently used as an education tool) are:

- Elluminate
- Oovoo
- Megameeting
- Skype

This list could undoubtedly be more extensive due to vast quantity of software packages or programs present in the market. But, these tools when developed were developed solely for the video conferencing. As mentioned elsewhere in this thesis, they were never meant for the education system. They can, however, be used as part of the educational endeavor but other software packages would need to supplement the array of tools needed to conduct a fully online class. Table 2.1[1] provides a comparison among these off-the-shell tools and their features.

On the basis of the collected data in Table 2.1, it is very clear that e-siksha in itself is a tool that has been created solely for the educational purposes. Also the major advantage associated to e-siksha is its pricing. E-siksha is completely free to use by all students and teachers for their classes. All the above mentioned tools, are either paid for by the users the demo/free version is only limited to a certain number of users with limited number of features.

2.3 MARKET SURVEY

A market survey across the web was performed. The survey was set to limited audience. A few questions related to distance education vs. the current education system

Table 2.1. Comparison for Tools in Market vs. E-siksha

Tools	Streaming Feeds Number	Screen Sharing	Text-Chat	Archive Access	Session Recording	Web-Based
Oovoo	6*	**Yes**	**Yes**	**No**	**Yes**	**No**
Adobe Connect Now	3	**Yes**	**Yes**	**No**	**No**	**Yes**
VSee	**No Limit**	**No**	**Yes**	**No**	**Yes**	**No**
SightSpeed	9*	**No**	**Yes**	**Yes**	**Yes**	**No**
PalBee	5	**No**	**Yes**	**Yes**	**Yes**	**Yes**
FlashMeeting	**No Limit**	**No**	**Yes**	**Yes**	**Yes**	**Yes**
MegaMeeting	16*	**Yes**	**Yes**	**No**	**No**	**Yes**
WengoMeeting	5	**Yes**	**No**	**No**	**No**	**Yes**
Skype	2	**Yes**	**Yes**	**No**	**No**	**No**
iVisit	8	**No**	**Yes**	**No**	**No**	**No**
e-siksha	15*	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Source: R. GOOD, *Best video conferencing tools that anyone can use – Videoconferencing sharewood guide*. Robin Good, http://www.masternewmedia.org/best_video_ conferencing_tools_that_anyone_can/, accessed April 2011, September 2008.

were answered. The whole idea behind this survey was to have an idea about what people in different parts of the world think about it. Some of the major questions in the survey were:

- Do you think distance education methodology should be used more often?
- Would they recommend going to traditional classroom or the distance classroom?
- Reason for why/why not do they think methodologies like distance education can help?

The survey was performed for audience belonging to different part of the world, with different age groups belonging to different professions. The idea was to find if people think the same way if they are in different profession or if they belong to same age group.

The link below provides access to the survey, which is now open for different inputs:

- http://www.surveymonkey.com/s/6PVC7T8

2.3.1 Survey Audience

The survey was set to a limited audience belonging to different age groups working as professionals in different parts of the world serving different occupations. The audience consisted of students, teachers, businessmen, and people working in different companies as bankers, sales representatives and software engineers. The idea was to get to know the thoughts all these people possess for a common topic – distance education.

2.3.2 Survey Analysis

A summarized version of the survey is that people all around the world do admire the use for distance education at some times but also believe that a distortion in the current classroom program might end up in negative results for the evolution of education system. The reason was the non availability of a distance education network. They all commonly admire having a network of distance education but step back because of its unavailability.

Theoretically, because of non availability of distance education system/tools, people have not witnessed the pros and cons of this new emerging system and their answers were commonly present based on the theoretical knowledge or the social knowledge that all have in them.

Following are the snapshots of some of the answers provided by people and the thoughts they possess for the distance education system.

No answers from any individual have been altered, however, for security reasons; the identity of the individuals is not being disclosed and is kept private. The screenshots in Figures 2.2 to 2.7 are taken from the survey results and analysis tool from www.surveymonkey.com , however, the survey was created by the researcher and was sent to a limited audience by personal email address. NO response in the snapshots belongs to the researcher as he did not want to take part in it.

2.4 REQUIREMENTS & DISCUSSIONS

Running through the complete end to end process for the e-siksha tool, yielded a number of system requirements. While some of the requirements were feasible, others were

1. Are you a Student/Teacher?
businessman

2. Can you provide me your age
<45

3. Do you think distance education methodology should be used more often? Do you think if you attend a lecture from a professor or any teacher over the internet using technologies like live webcams,mics, headphones and chat session is better then sitting in classroom?? What if over the internet you are attending a class which feels exactly like a regular traditional classroom but you are not in class room you are at home and you have same privileges that you have in class, you can raise your question to the lecturer, you can discuss a topic with your friends. Do you think it is better this way or the traditional classroom is still better? **YES or NO** please provide 2-3 lines supporting your answer**
It is both ways .In some cases some students need personal attention which includes fear even thus gives u results but as if in the present times this class on internet seems better as u can go deep upto your lavel of thought process and can attain satisfaction, which is not possible with the earliier method

4. Would you recommend going to the classroom? IF No, why don't you want to go to the classroom?
yes Definately because there r socio interactions along with punctuality.You face the things and personalities.

5. If given an option to you or your son/daughter, would you enroll for a course with distance education methodology? **Please provide comments in supporting your answer**
yes. As this is a better way in coming times.

6. DO you think can Methodologies like Distance Education can help improve the Education System?
Yes

Figure 2.2. Survey response 1.

1. Are you a Student/Teacher?
No
Banker

2. Can you provide me your age
31-35

3. Do you think distance education methodology should be used more often? Do you think if you attend a lecture from a professor or any teacher over the internet using technologies like live webcams,mics, headphones and chat session is better then sitting in classroom?? What if over the internet you are attending a class which feels exactly like a regular traditional classroom but you are not in class room you are at home and you have same privileges that you have in class, you can raise your question to the lecturer, you can discuss a topic with your friends. Do you think it is better this way or the traditional classroom is still better? **YES or NO** please provide 2-3 lines supporting your answer**
No. The interaction and camaraderie of school life is a very important learning experience in a child's life. Distance education should be widely used in situations where it is difficult for the child to reach school or it is difficult for the teacher to reach the school.

4. Would you recommend going to the classroom? IF No, why don't you want to go to the classroom?
Yes

5. If given an option to you or your son/daughter, would you enroll for a course with distance education methodology? **Please provide comments in supporting your answer**
No. As explained above.

6. DO you think can Methodologies like Distance Education can help improve the Education System?
Yes
Distance education can help increase the reach of education and enable the masses to get access to it.

Figure 2.3. Survey response 2.

1. Are you a Student/Teacher?

Yes

2. Can you provide me your age

26-30

3. Do you think distance education methodology should be used more often? Do you think if you attend a lecture from a professor or any teacher over the internet using technologies like live webcams,mics, headphones and chat session is better then sitting in classroom?? What if over the internet you are attending a class which feels exactly like a regular traditional classroom but you are not in class room you are at home and you have same privileges that you have in class, you can raise your question to the lecturer, you can discuss a topic with your friends. Do you think it is better this way or the traditional classroom is still better? **YES or NO please provide 2-3 lines supporting your answer****

I am in favor of distance education. However, the traditional classroom set up is completely in the hand of the teacher as to how to make the classroom set up interesting and comfortable for the students.. The seriousness towards education from the students perspective would take a back a seat if the modes like internet technologies would be used. A scheduled classroom set up classes should be conducted even in distance education unless and until if the education is from some other country.

4. Would you recommend going to the classroom? IF No, why don't you want to go to the classroom?

I would surely recommend going to classes.

5. If given an option to you or your son/daughter, would you enroll for a course with distance education methodology? **Please provide comments in supporting your answer**

Yes i would consider distance education as an option for my child if they wish to undertake some course in this manner.

6. DO you think can Methodologies like Distance Education can help improve the Education System?

Yes

How the current distance education system is functioning - without any classes or tutorials, incorporating internet technology would be helpful.

Figure 2.4. Survey response 3.

1. Are you a Student/Teacher?
Yes

2. Can you provide me your age
21-25

3. Do you think distance education methodology should be used more often? Do you think if you attend a lecture from a professor or any teacher over the internet using technologies like live webcams,mics, headphones and chat session is better then sitting in classroom?? What if over the internet you are attending a class which feels exactly like a regular traditional classroom but you are not in class room you are at home and you have same privileges that you have in class, you can raise your question to the lecturer, you can discuss a topic with your friends. Do you think it is better this way or the traditional classroom is still better? **YES or NO** please provide 2-3 lines supporting your answer**
traditional classroom is better as it gives a person confidence of how to interact with people well and understanding things better.

4. Would you recommend going to the classroom? IF No, why don't you want to go to the classroom?
yes as classroom is a place where we meet different people from different backgrounds. We get a chance to understand people better.

5. If given an option to you or your son/daughter, would you enroll for a course with distance education methodology? **Please provide comments in supporting your answer**
no, this will hamper their exposure to the world

6. DO you think can Methodologies like Distance Education can help improve the Education System?
Yes
distance education is benificial for the people who have to leave studies or cannot continue their regular studies due to bad circumstances.

Figure 2.5. Survey response 4.

1. Are you a Student/Teacher?

Yes

2. Can you provide me your age

21-25

3. Do you think distance education methodology should be used more often? Do you think if you attend a lecture from a professor or any teacher over the internet using technologies like live webcams,mics, headphones and chat session is better then sitting in classroom?? What if over the internet you are attending a class which feels exactly like a regular traditional classroom but you are not in class room you are at home and you have same privileges that you have in class, you can raise your question to the lecturer, you can discuss a topic with your friends. Do you think it is better this way or the traditional classroom is still better? **YES or NO please provide 2-3 lines supporting your answer****

I am neutral in this case. While I love the traditional classroom style. I believe that the advance of distance education allows more flexibility, the potential to learn from anywhere in the world and collaborate across geographical barriers.

4. Would you recommend going to the classroom? IF No, why don't you want to go to the classroom?

Classrooms are places where we learn much more than bookish knowledge and get to rub shoulders with our peers and also gain personal attention and individual and team skills. Something that is hard otherwise.

5. If given an option to you or your son/daughter, would you enroll for a course with distance education methodology? **Please provide comments in supporting your answer**

I would prefer classroom instruction. There is much to impart and observe which gets limited when it's distance learning

6. DO you think can Methodologies like Distance Education can help improve the Education System?

Yes

It is the future and also if provided with the right infrastructure, the way to include and involve more people and educate more.

Figure 2.6. Survey response 5.

1. Are you a Student/Teacher?
No
Retail Professional

2. Can you provide me your age
31-35

3. Do you think distance education methodology should be used more often? Do you think if you attend a lecture from a professor or any teacher over the internet using technologies like live webcams,mics, headphones and chat session is better then sitting in classroom?? What if over the internet you are attending a class which feels exactly like a regular traditional classroom but you are not in class room you are at home and you have same privileges that you have in class, you can raise your question to the lecturer, you can discuss a topic with your friends. Do you think it is better this way or the traditional classroom is still better? **YES or NO** please provide 2-3 lines supporting your answer**
Traditional If distance and time are not constraints then it would be preferable to be in regular classroom. There is lot about human interaction which cannot be taught through webcams.

4. Would you recommend going to the classroom? IF No, why don't you want to go to the classroom?
Yes

5. If given an option to you or your son/daughter, would you enroll for a course with distance education methodology? **Please provide comments in supporting your answer**
Maybe

6. DO you think can Methodologies like Distance Education can help improve the Education System?
Yes
For people who cannot for some reason visit classrooms, distance education is the way to go.

Figure 2.7. Survey response 6.

not. Among these requirements the most important were selected for the successful implementation of the tool as per the education system perspective. Consultations with computer scientists yielded a set of customized requirements best for tools implementations; I ended up customizing the requirement pool which was best needed for the tool's implementation.

Some of the non-feasible requirements were also required as a priority but because of certain factors and dependencies, the exact requirements were not met However, altering those requirements to a much more feasible form helped obtain my so called, Requirement Pool.

Discuss the Requirements: "Discussion on the requirements is very essential. This helps in clarifying the mist cloud of requirements one need to implement. Because of these discussions only, I was able to form the Requirement Pool. Giving a highlight of these discussions is only to give you an idea about how the Requirement Pool would be generated and they become more clear and precise."

Some of the most important consultations regarding the implementation of the tool were centered on the following questions:

- Would it be Cloud App or not?
    - Let's make both. Teacher working on desktop app and students getting everything on Website as a blog. Yes☺
- How would we get to know if the student is actually sitting in the class or just faking it by logging in and moving around?
    - Automatic Attendance meter?
        - It will check the status of student in every say 5-10seconds. Yes☺
- What means would the student have in order to raise a question?
    - Text Chat? Or a Raise a question button? Or Audio Capability on their end?
        - Drop the button scenario. We would have a text chat and Audio capability.
- If we give audio capabilities to students, they can just start talking anytime and teacher would not have the capability to ask him to be quiet. How do we control this?
    - Drop the Audio capability from students. They would just listen, if they have a question, they will use the text chat option for it. Yes☺
- Restricted to SDSU students?

    - Technically, because of security reasons, the website can not be open outside SDSU. But still if it is placed on any outside server, it will be open for all.
- This strategy of placing the website on open server might compromise the security policies of SDSU?
    - No. It is just a simple blog, with lectures recorded in it. The knowledge should be free for all. If a student sitting in India wants to learn French under a professor, he can use this application and can learn it without travelling here. And he would have access to all the lecture sessions previously also. Knowledge is free for all and it should be available to all. But we are not putting it outside, so we are good in that manner. Yes☺
- On Open server or even in closed secured server, the student can break in?
    - They would get anything, except the recorded lectures. They can anytime get it on the website, why would they have to break the website. The website is not connected to any SDSU registration or cashier server. It is independent of all. The email list of students would be chosen by the lecturer itself dynamically, so they can not even steal any email addresses. Yes☺
- What if, as a professor, I need to show them something on whiteboard in my office?
    - Professor's webcam would be turned on, through out the lecture. Yes☺
- Would SDSU/Student/Professor have to pay something to any one or acquire any licenses before using this tool?
    - No, this is an open source tool. Moreover, this is the version1.0, so any upcoming student can upgrade the tool to the next version for better use of the tool for education. Yes☺
- Where would we store the lecture recording?
    - Either on Professor's computer or the server directly!
        - Professor's computer would fill up because of the video sizes, sometime down the road of using this tool. We would store the videos directly on the server. Professor would just have to end the class and publish it. Everything would be done at the backend from saving the video to publishing it on the web. Yes☺

After a careful and times of discussions regarding the tool and its requirements and the functionality of tool, the requirement pool was created. The requirements pool clearly indicated the need of the following 6 major components:

- Desktop Application: A desktop application would be required for the professor's computer, so they can start and stop the lecture. They can let the students know about the access codes for attending the next class.
- E-siksha website: A website would be needed for the student's end point, where they would be able to see the live broadcast of the class. Later they can also access the archive for checking out some missed sessions, if they want to re consider

- Live Streaming: Access to live class, is the sole idea for e-siksha so the student can access class sitting anywhere in the world.
- Screen Sharing: Sharing professor's computer screen among all the students, so they can see what slide or what diagram or piece of code etc is the professor talking about.
- Screen Recording: Recording the entire lecture from the professor's point of view, so that after the lecture is over, they can post the lecture on the e-siksha website for later use by student, if needed.
- Text chat: For students, to raise any questions or to ask any doubt, a group chat would be needed for better communication among students.
- Audio/Video Capability: The professor should have the audio/video capability in order to talk to the student. We could not expect the professor to write down the lecture through the text chat component. Professor would need to have a microphone and a webcam to start the audio/video features. They are extremely necessary from the professor's end. The student's end however is currently not supported with audio/video capability, they would have text chat component only to work on.

2.5 PLANNING

Planning is the most important part and integral part for software building. It has to be done, right after the requirements have been made available. If one is directly coding the software, there is a strong possibility that one might have to either dump the current project or start from scratch.

Planning for software development gives an insight on the development path for the software. While working on e-siksha, many failures and challenges in the development process occurred because of poor planning, or rather, from the vast array of available options from which to choose. Selecting the wrong options lead to delays and false starts or dead end paths.

Once the Requirement Pool was created, the planning for the execution of the tool began and the following questions were front and foremost:

- How would I be creating it?
- How would I get a hold of these components we discussed earlier?
- Even if components are available online for free, how would I integrate them?
- Where would I be integrating them?
- What platform, would I require to integrate them?
- If they are not available, how would I code them from scratch?
- If I code them from scratch, then what would be my integration platform?

These are but a few of the questions which arose in the planning process. in order to get the e-siksha off the ground. Once the components were controlled for and integrated in one platform, the class could be conducted.

CHAPTER 3

TECHNOLOGIES

3.1 FACTS ABOUT TECHNOLOGIES

Talking about technology today is a very common thing. There are so many of them available with so many different features. An important thing to notice is that there is not just one technology available to us for accomplishing a task. Alternatives are present at every step, even in the world of technology, but to gain the most from a project, the preference given to a technology depends on the end users' needs. The negative side of choosing a technology is, if you are not aware of all the technical features or half way across the project completion you come to know that a product feature you intended can be implemented by the chosen technology, the whole project would be scraped and eventually have to start again from square one.

The requirements for the project e-sIKSHA were such that a Web based technology had to be chosen. Another criterion for choosing a web technology is the compatibility. Having studied the requirements of this thesis project, its purpose and the compatibilities required HTML, PHP, CSS, Apache, WordPress and MySQL emerged as the most appropriate choices. Since most of these technologies are compatible with almost all operating systems, implementing e-sIKSHA.

The technologies chosen are also free, open source technologies available on the web everywhere. The most common open source free package available is XAMPP. XAMPP is an acronym for **X** (read as cross, meaning cross platform) **A** (Apache) **M** (MySQL) **P** (PHP) **P** (Perl). It is a free open source web server package which when installed on any machine turns it into a server capable of serving dynamic web pages [2].

3.2 JAVA

Java is an Object Oriented Programming language initially developed at Sun Microsystems. The language has most of its syntax similar to C and C++ but has an object

model. The real idea behind developing java was to have a general based, concurrent, class based object oriented language which has few implementation dependencies as possible.

The original implementation, class libraries, java compilers and virtual machines were designed by Sun Microsystems in 1995 but in 2007 Sun released most of the Java technologies under General Public License.

Some of the most significant language features [3] are:

- Object Oriented
- Platform Independent
- Compiler/Interpreter Combo
- Applet Interface
- Distributed
- Portable
- Dynamic Binding
- Secure
- Performance
- Multi Threaded
- Built in Network

All of the above mentioned significant features [4] along with being open to public users make Java an outstanding choice for programming. Some of the areas of application of Java are:

- WWW Applets
- Network Applications
- Cross Platform Application Development

Java is a cross platform application maker, so the java application created does not depend on which platform it is created on. It will run on all platforms be it Windows, Linux, Mac, just as long as the platforms have JVM installed in them. Today not only Computers but also cell phones have Java in them making it possible to run applications on them.

3.3 WEB TECHNOLOGIES

Choosing a Programming language out of so many available can be like finding a needle in a storm, but this situation can be resolved to at least 50% if the requirements are

very solid and consistent. Some of the factors like Machine independency, Multi user access, load handling, user operating system along with more complex factors related to cloud computing enter the zone to create mist of these technologies. More clearly the requirements are specified, the better the atmosphere evolves for the user to pick appropriate technology.

3.3.1 PHP

PHP is an acronym for PHP: Hypertext Preprocessor. It is a powerful and efficient tool for web development. PHP is a server side scripting language which means that the end user would not be able to see the powerful scripts running on the webpage at the backend.

It is a widely used free tool for making dynamic and interactive web pages. The syntax in PHP is borrowed from a couple of different programming languages, some of which are C, JAVA and JavaScript. Along with these PHP has some of its own salient features also which makes it's a choice of majority of web developers to go for. The goal of this language is to simply create dynamic and interactive web pages with as much simplicity as possible. This is the reason why PHP in today's market is a great competitor to Microsoft ASP.

The use of PHP has grown immensely during the last couple of years and not to mention it dominated the web market completely. The PHP usage statistics from April 2007 shows that the number of websites already exceeded the 20000000 mark [5].

The reason ever increasing demand, as we see in Figure 3.1 [6], for PHP is its simplicity. The language is designed specifically for web development. As mentioned in my building example in 1st chapter, since the language is intended for web development, it works in the best possible way. The use of PHP is so simple and understandable that anyone can just start learning it and would end up building interactive websites in no time.

The other reason for the PHP to the distance is its speed. Once we have the webpage ready with PHP all the scripting work would be done on the server as it is a server side scripting language. So the end user, whenever he or she works on the website is not aware of the scripts running at the backend. The scripts are actually running at the server level so it takes less time to perform action.

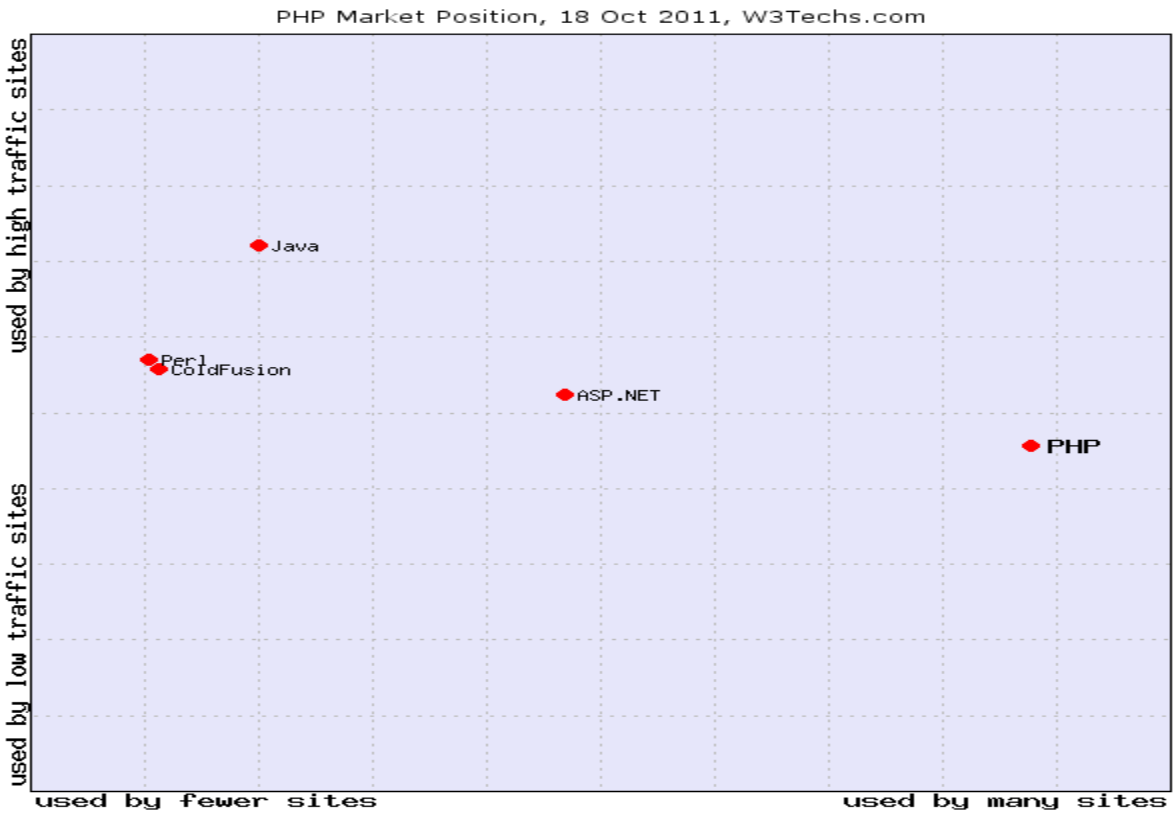


Figure 3.1. PHP usage graph. Source: W3 TECHS, *Usage statistics and market share of PHP for websites*. W3 Techs, http://w3techs.com/technologies/details/pl-php/all/all, accessed January 2012, n.d.

PHP is a cross platform scripting language. Thus, the pain of cross platform delivery is eliminated right from the start. Being a part of open source makes it free for everyone with more security and much more compatibility.

Some of the most important application based usages of PHP are Application Control – for example to control the login feature of a website. File Access is another feature – performing basic read/write operation on documents along with file and directory maintenance can be handled. These are some of the most common reasons why PHP is growing at such a steady rate and dominating its power.

The growth of PHP has increased so much as we see in Figure 3.2 [7] that it has now become an easy to choose, effective and free alternative to Microsoft's ASP. The top 10 website industries have already moved to PHP and the numbers are growing rapidly. The graph in Figure3.2 shows the PHP usage in the top 10 website industries [6]. The most recent

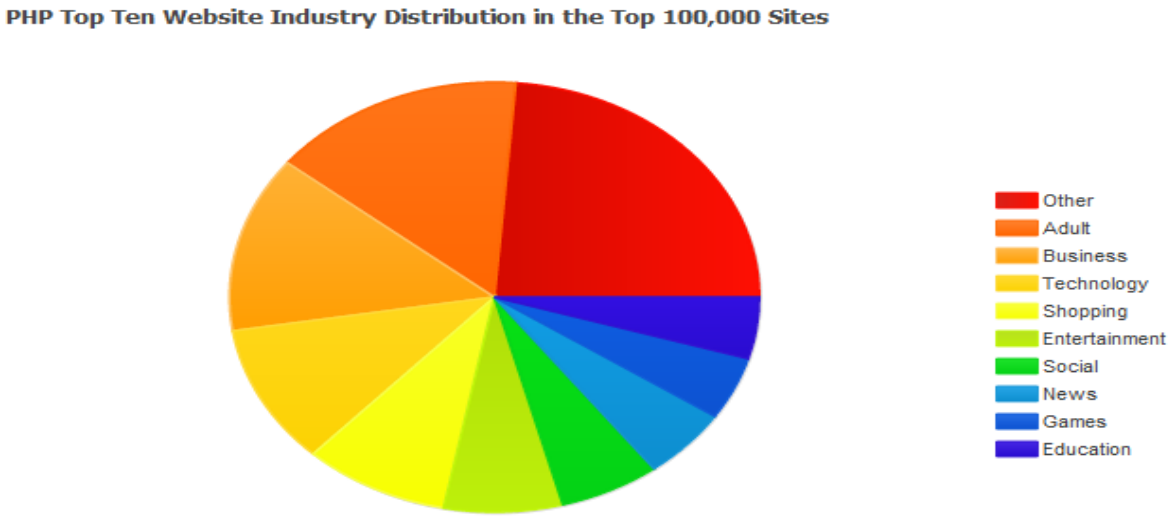


Figure 3.2. PHP industry distribution graph. Source: BUILTWITH, *PHP usage trends*. BuiltWith, http://trends.builtwith.com/framework/ PHP, accessed January 2012, n.d.

statistics shows that we are currently aware of 25,382,708 sites [7] which are currently using PHP.

3.3.2 JavaScript

JavaScript is most popular and easy to adapt scripting language which works with all the major Web Browsers. Developed by Netscape, the whole idea was to make the web pages more interactive. The JavaScript code interacts with HTML code very efficiently thereby giving the web developers a privilege to increase the efficiency of their web pages both dynamically and interactively.

It is a light weight scripting language which can be embedded inside the HTML code. It is an open source interpreted language – scripts can execute without any compilation. The language supports object oriented, imperative and functional programming styles. Because of its easy to use style, anyone with basic knowledge of web designing can start using Java script and create and run scripts in no time. Some of the application based usages of JavaScript are

- Programming tool – The HTML users and developers can now use this language as their programming tool because of its easy to understand and write feature. You can write small chunks of programming and insert them in your HTML code and then can control it the way you want.

- Respond to Actions – The language has the capability to respond to various actions happening on the web page. For example the mouse hovering. If you want a pop box displaying ‘Good Morning’ whenever the user hovers the mouse over a specific area, JavaScript can make it happen.
- Validations – JavaScript can be used in online forms to validate the data. Usually whenever a user presses the send button after filling the form, the form would go to the server perform the validation and then would return back with results. JavaScript allows the functionality to perform validation checks right there when the user is filling the form. So the form does not have to go to the server for basic validation and avoid this back and forth movement.
- Cookies – JavaScript can be used to create cookies. With the help of cookies, you can retrieve information from the visitor’s machine without notifying him. However this is not according to the ethics and can lead to Cyber crimes, but this can be used in good ways where you can store cookies on visitors machine and then whenever the user comes back again, he would not have to wait for same time he did for first time.
- Plug-ins – JavaScript allows you to create plug-ins for various purposes that can be embedded in the code resulting in a more dynamic web page.

3.3.3 CSS (Cascading Style Sheets)

CSS is a language which stands for Cascading Style Sheets and as the name indicates – it is used to control the layout of multiple web pages all from one single sheet .css file. The styles define how the web pages should look like.

It is a most common language these days for web developers as they do not want to get in to hassle of updating and maintaining the look and feel of different web pages by updating the html code of each and every page. The idea behind developing CSS was to control the look and feel of different web pages on a web site by one file.

There are 2 types of CSS:

- External CSS: The external CSS is a separate document from the web pages. The document handles all the styles and formatting of a web page which the developers wants. He can save all these formats and simply call this external sheet in the web page and use any method he wrote in the sheet on his web page along with the regular html tags.
- Internal CSS: The Internal CSS however, also performs the same role, but there is no need separate file which is created. Inside the html file the format is declared and it works the same way.

Most developers prefer to work to work with external CSS sheet as this gives them flexibility to control all the web pages with similar format at once.

The history behind creation of CSS is that as the web world was growing rapidly, the web pages present online were increasing. The websites started have more then just one web page and looking today any website would not just fit in a one web page. There would be a couple of web pages and no one wants to keep updating and formatting each and every single web page. Thus the need of a language arose, from where a consistent approach of providing styling approach for web documents can be handled [8].

Benefits for CSS can start from the following:

- Easy maintenance for the layout of web pages.
- Less LOC(line of code) to be written
- Downloading speed increases enormously for a page using CSS
- Easy to debug issues – as without a CSS the whole page would line up in rows.

3.3.4 HTML 5

Using the latest and most advanced technology in the field always has advantages which will be more long-lived. It will remain till more time. HTML is a very new language, available from 2009. Please find the timeline generation of HTML technology in Table 3.1 [9].

Table 3.1. shows a rough timeline for the Web Technologies present. Interestingly HTML5 is a combination of HTML + CSS + JavaScript. HTML5 has new attributes, new elements, new tags, local storage, Audio & Video capability, Complete CSS integrated. HTML5 is by far the most advanced and known web technology available for free to all. All that is needed is to open a new notepad file, rename it by changing the extension to html, and start coding [10].

3.4 XAMP

Using an Apache Web Server and developing a web based product, I would need a web site to launch the product requires a web site to launch the product and a web server to house my website. Since PHP Web Technologies are all open source. XAMP seemed a most appropriate choice. XAMP is a free open source web server package which when installed on any machine turns it into a server capable of serving dynamic web pages. XAMP is the package which delivers PHP, Apache and MySQL all in one package.

Table 3.1. Web Technologies Timeline

Year	Technology
1991	HTML
1994	HTML 2
1996	CSS 1 + JAVA SCRIPT
1997	HTML4
1998	CSS 2
2000	XHTML 1
2005	AJAX
2009	HTML5

Source: M. WICHARY, *Rough timeline of web technologies*. HTML5 Rocks, http://slides.html5rocks.com/#timeline-slide, accessed February 2012, n.d.

Apache is an open source Web Server, developed and maintained by the open source community developers. Apache is an easy to install open source Web Server, which can be used by any one and thereby anyone, upon installing apache on their machine, can convert their machine to a web server.

Apache in 2009, was the first Web Sever to surpass a 100million website milestone, which means 100 million websites are using Apache as their web server [11].

The sole idea behind developing Apache was to have an open source HTTP Web Server for modern operating system including UNIX and Windows NT. The idea behind creating Apache was to create a robust, commercial-grade, feature full and freely available software upon which individuals can work and on and keep on expanding it beyond the limits. This is possibly the reason why Apache was the first server to exceed the 100million mark.

Some of the main reasons why Apache is considered by majority of individuals today are:

- Free: Apache is free, being open source software, there is no charge in downloading it and using it to for personal or commercial use.
- Customizable: Apache is developed by many developers sitting all around the world and meeting and discussing together to make this software even better. This is the result that architecture Apache uses, is highly customizable and can be used the way user wants it to use
- Portability: Apache is designed to run on almost all the operating system present today including UNIX and Windows NT.
- Extension: As I mentioned earlier, the software can be extended the way user wants it to. If a feature is not available in apache, the developer can write their own code and can make it work which is not possible when using servers like Microsoft IIS.

3.5 RED5 MEDIA SERVER

The Open source media Server is a dominant yet great open source solution to multi user audio/ video streaming. The Red5 server is writing in Java and supports Audio/ Video streaming, recording Client Streams, Live stream publishing etc.

The Red5 server is a great alternative to the famous Adobe FMS or Wowza. Both the Adobe FMS and Wowza are paid and no doubt have great success. But everything in the end comes to budget. Paying more than a $1000 annually would be given a thought, if you have the same powerful server with same great features available to you for free [12].

The Red5 supports the latest multi user API's while providing a powerful RTMP/ Servlet implementation. In addition it has an embedded Tomcat servlet container for JEE Web applications. Some of the advantages [13] for using Red5 server by the provider are:

- Broadcasting live streaming events.
- Efficient video playback
- Video files are all run and stored on server, nothing is present on clients machine
- Hands on at the detailed statistics and diagnostics of the server performance.
- Provide interactive content such as live chat, video conference, recording, etc.

3.6 JW PLAYER

A product by Long tail Video, the JW Player is a world class solution to embed videos and make them available everywhere IPad, IPhone, Android devices, laptops,

computers, server, etc. The player has support for Flash, so instead of using regular media players which are compatible to one type of system and not to other is of no use [14].

The JW Player works with HTML5 which is the client side of e-siksha and flash, in which almost all the videos are running over the internet.

Some of the advantages [15] of the JW Player are:

- Support for Flash and HTML5
- Manage multiple custom players
- Support for adding external video to media libraries, including YouTube and RTMP streams

3.7 PROTOCOLS

Protocols in computer networks can be defined as a set of rules used to communicate between different devices. Packets are used in order to send or receive messages between the different network devices.

3.7.1 RTMP Protocol

The Real Time Messaging Protocol (RTMP) was initially designed for transmission of audio and video data specifically between adobe technologies. Adobe has now released the specification of protocol to public to create products and technologies which enable delivery of audio and video data compatible with adobe flash player [16].

The protocol uses a binary TCP connection or a HTTP tunneling to deliver the real time objects like Audio/ Video to clients. A single connection would multiplex many streams using different channels. Within these channels, packets are split up into fix size body chunks [17, 18].

3.7.2 HTTP Tunneling

This is a technique in which all the network protocols which are being are worked are wrapped up using the HTTP Protocol. The idea is to encapsulate all the communicational data and then send and receive it using the http protocol.

The http tunneling is most often used in places with restricted network access – like behind firewalls etc. Consider the following example to understand the mechanism behind the http tunneling [19].

The user that wants setup a remote connection with the remote server makes an http connection with another server which acts as a mediator server between the user and the remote server. The mediator server is supposed to be located with sufficiently unrestricted access. So the user makes the connection with this mediator server using http requests. The actual data to be communicated to the remote server is hidden inside the requests. The mediator server receives the http request and opens it before forwarding it to the remote host server. Similarly when the mediator server receives the data from the remote host server, the mediator server wraps the data in http protocol, before sending the http response. This http response has the data to be transmitted to the user from the remote host server.

3.8 LIBRARIES

There are various libraries which are used during the creation of e-siksha. Some of the most important libraries which were used were as follows.

3.8.1 Xuggler

Xuggler is a library with help of which user can encode, decode, modify any media file. The lava library is Java. Xuggler which is available for public license. Xuggler consists of a set of java and other native libraries and are available with two API's [20].

- Media Tools API – for basic user to encode and decode audio/video files
- Xuggler API – for advanced users to encode and decode audio/video files

3.8.2 Robot

The Robot class in java is primarily used for test automations, or self- running demos, where input from keyboard and mouse are needed.

The class is used to generate input events. For example, if I have to move a mouse, a simple AWT event queue would just have mouse move events whereas the robot class of java would actually move the mouse [21].

3.8.3 JMF

JMF stands for Java Media Framework. JMF is an Application Programming interface for integrating media files into java applets and applications. The JMF is easy to

design API which supports capturing of media data along with enabling users to develop various JMF Plug-in for custom multiplexers and de multiplexers [22].

CHAPTER 4

DESIGN

4.1 ARCHITECTURE DESIGN

The Architecture for e-siksha is based on 3-tier model. The Traditional 3-tier architecture model uses Client-server Architecture. All the models in this architecture are separately developed. This has an advantage, that down the road for upgrading or changing any model, you would have to work on only that model. The other model would just need the proper synchronization with the newly created model. You don't end up changing the whole application just to change 1 model.

I used the same architecture in e-siksha also. The User Interface, The process logic and data storage were developed and maintained as entirely different and independent modules. The 3-tier architecture contains the following 3 layers [23], as also shown in Figure 4.1 [24].

- Presentation Layer: The top most tier which communicates with other tiers and displays the result to the browser or client using the user Interface present in the application.
- Business Logic Layer: The second layer, where the business process logic is working based on the request from the client. It acts as a liaison between the presentation layer and the data layer.
- Data Layer: The 3rd tier in the 3-tier architecture and the most important also. The tier covers the storage of data. The information is stored and retrieved. It keeps data independent of the earlier two tiers thus improving performance and scalability.

Figure 4.1 shows the traditional diagram of a 3-tier architecture diagram which includes the 3 tiers discussed above.

Figure 4.2 shows the 3-tier architecture of e-siksha.

Figure 4.3 illustrates the internal working of the Business Logic Layer. It provides a clear insight of which library does what role and how the whole flow works as soon as the Start Class button is pressed by professor. As soon as the Professor Presses the Start Class button, different threads are fired. Each thread performing different role. The Robot library,

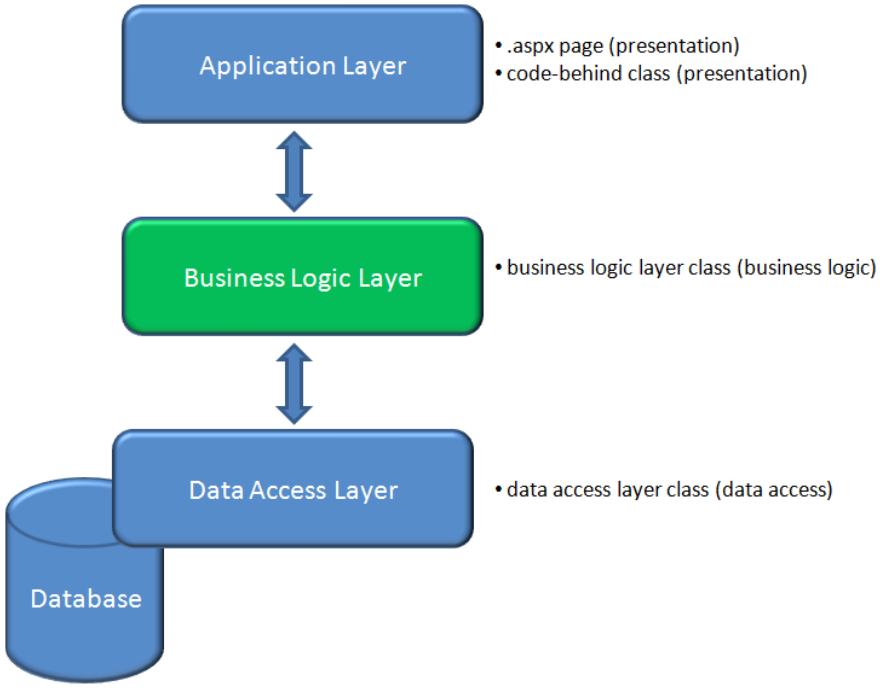


Figure 4.1. Traditional 3-tier architecture diagram. Source: BLOGSPOT, *Multitier architecture diagram*. Blogspot, http://1.bp.blogspot.com/_2xVO7-o3CJo/S96yh3U5_2I/AAAAAAAAAjc/CFbUMIl20no/s1600/3tier.png, accessed February 2012, n.d.

Xuggler library and the jvm are all connected to individual threads. The Robot library captures the screen and encodes it with the image captures by Xuggler library. The Xuggler library captures the live webcam. Both when encoded are converted to a buffer image. The JVM on the other hand is capturing microphone. The buffered image and the jvm captures are then encoded together which creates a Packet. A copy of this packet is sent for Live Streaming and another copy is saved on Local machine. When eventually in the end, professor presses the end button, all these threads are killed immediately and the copy which is being saved on local machine is now placed on server, so that it is available in e-siksha archive.

4.2 DATABASE DESIGN

The initial idea behind the development of e-siksha was to try and push back as much as possible to not to implement and use any database. But because of the change in requirement, eventually I had to include Database. My Sql database is what I used in

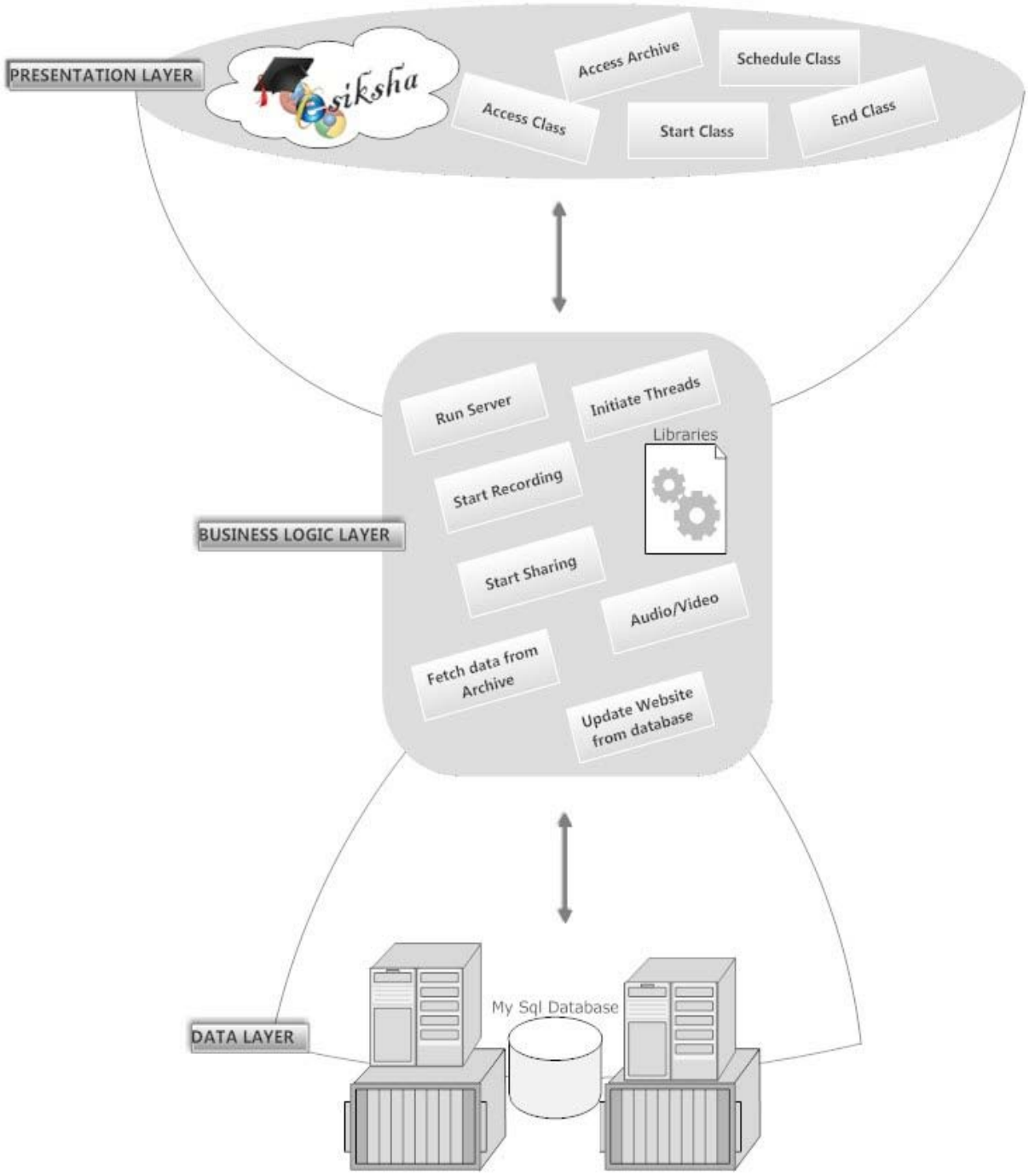


Figure 4.2. Architecture diagram (3-tier model) of e-siksha.

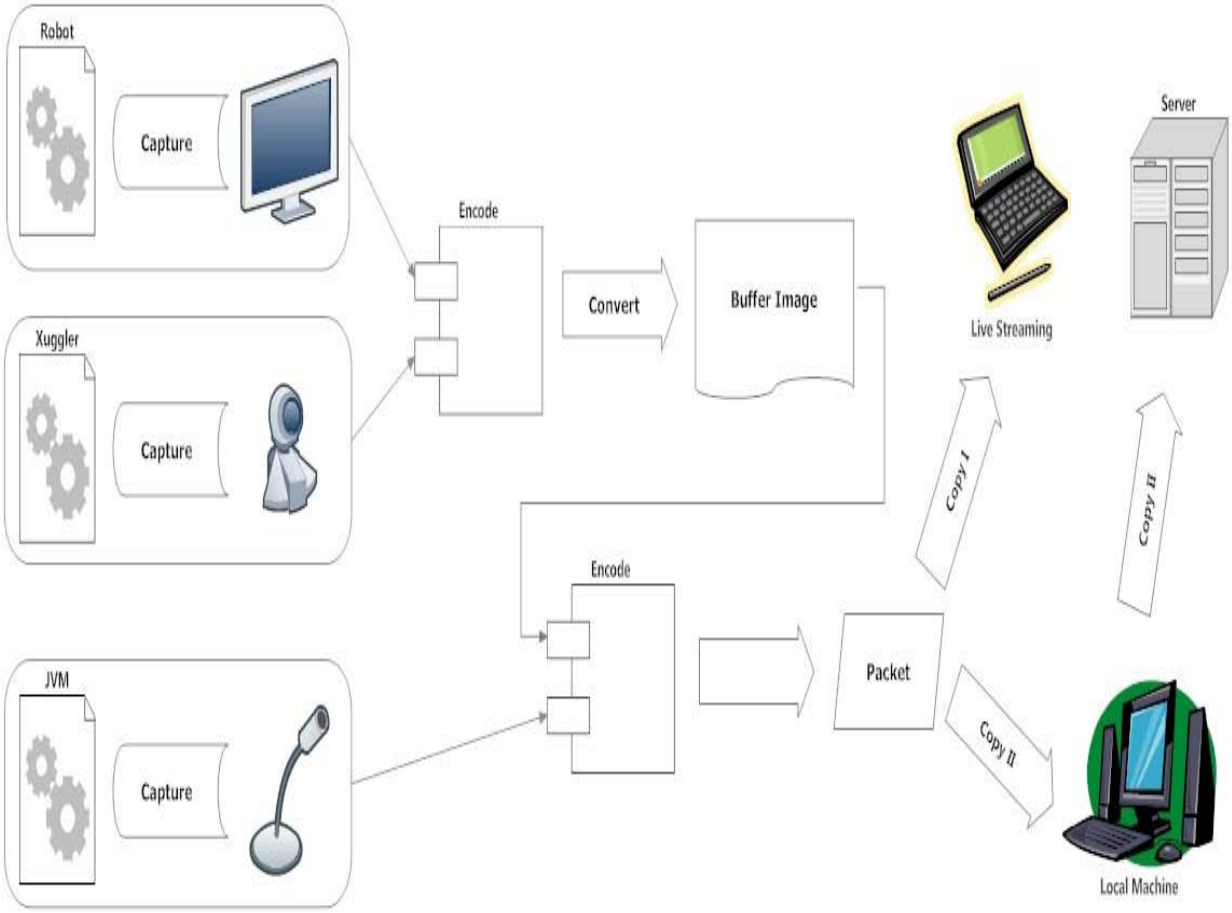


Figure 4.3. Internal working of start class button.

e-siksha. The database is simple with no heavy table or views. The use of data base comes when I had to store the videos which are being recorded during and class and eventually show them on website. For this reason, I created only 4 tables in database as seen in Figure 4.4.

- Class Table, Chat Table & Status Table: These three tables would be truncated in the end when a professor ends the class. They are only used when a live class is streaming. This database would have all the details needed in order to store the data as well as other details related to class. Class table is used to store the name of the file, the chat table to store the chat temporarily and the status table to keep checking the status of students.
- Encryption in Database: The Class table has a field name password. The password field is actually the Red ID of the professor which has to be entered manually by the systems administrator. The password which is sent to students is actually an encryption of the Red ID professor enters here along with a random number provided by the professor. On the viewer end, when student enters the password, the password is decrypted on the fly and the Red ID is generated. This Red ID is then matched with

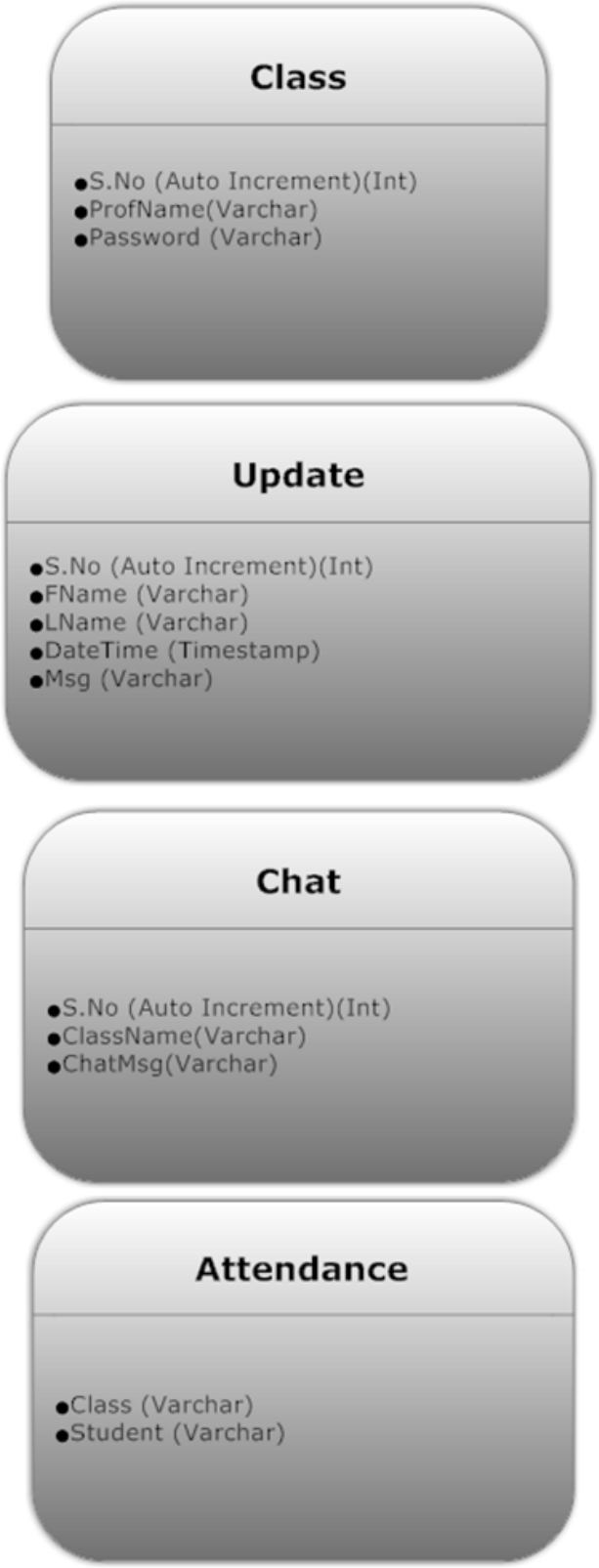


Figure 4.4. Database tables used in e-siksha.

the Red ID of the professor which is stored manually in the database. This is how the whole encryption process is working around the e-siksha login system.

- Update Table: The Update table is the table which would not be truncated in the end and would be present always so that professors can update e-siksha website directly from the application. The following figures are the Entity-Attribute diagram of the Database I designed

4.3 SYSTEM DESIGN

With System Design, I try to uncover the analysis part of e-siksha. How the whole project was analyzed before and during the development process. It is really important since, this creates a sketch or what would be happening after a particular action/state. How the flow would be moving in the system. Most importantly what would happen after a particular action and what actually is happening behind the scenes?

4.3.1 Use Case

A Use Case diagram are actually made in order to make an external or a new user, better understand the system. These are basically scenarios which depicts how the system would respond to a particular request.

4.3.1.1 USE CASE I (SCHEDULE CLASS)

Scheduling a class takes some extra steps then simply starting the class as we can see just by looking and comparing Figure 4.5 and 4.6. The professor would have to launch the e-siksha desktop application and provide details like name, date & time of class, class name, a self chosen password which would be used by students to access the class and the email list. The email list would be a text file which would have email for all students, professor wants to attend class. Professor can manually add the email address of any student they want and eventually just save the file on their machine. When scheduling the class, all they would have to do is to choose that file and fill in the details, e-siksha will automatically send email to students with the details that need to be sent in the email.

4.3.1.2 USE CASE II (START & END CLASS)

To start a class, professor would have to launch the e-siksha desktop application and provide their name and class name in order to name the video which would be generated after recording.

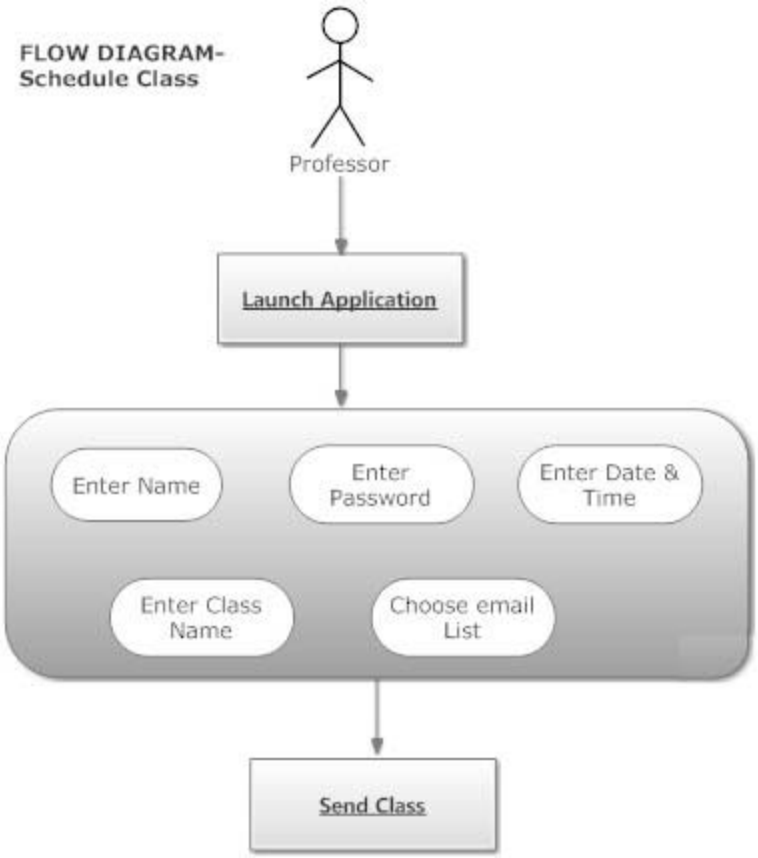


Figure 4.5. Schedule class - Use case diagram.

To end a class, professor would have to re launch the already open e-siksha desktop application and press the end class button. The end class button would kill all the threads running at the background eventually triggering a thread to save the recorded file into a location and changing the name of file to a standard naming convention.

4.3.1.3 USE CASE III (VIEW LIVE CLASS)

For accessing a live class, e-siksha website is the place where the student or the professor would have to go. The Access Class link as shown in Figure 4.7 would direct the user to another page where the system would require a password. The password would be the same which the professor chose while scheduling the class. The user would have to enter the same password. If the password matches the password present in the database, the user would be directed to the class session and can view what the professor is teaching.

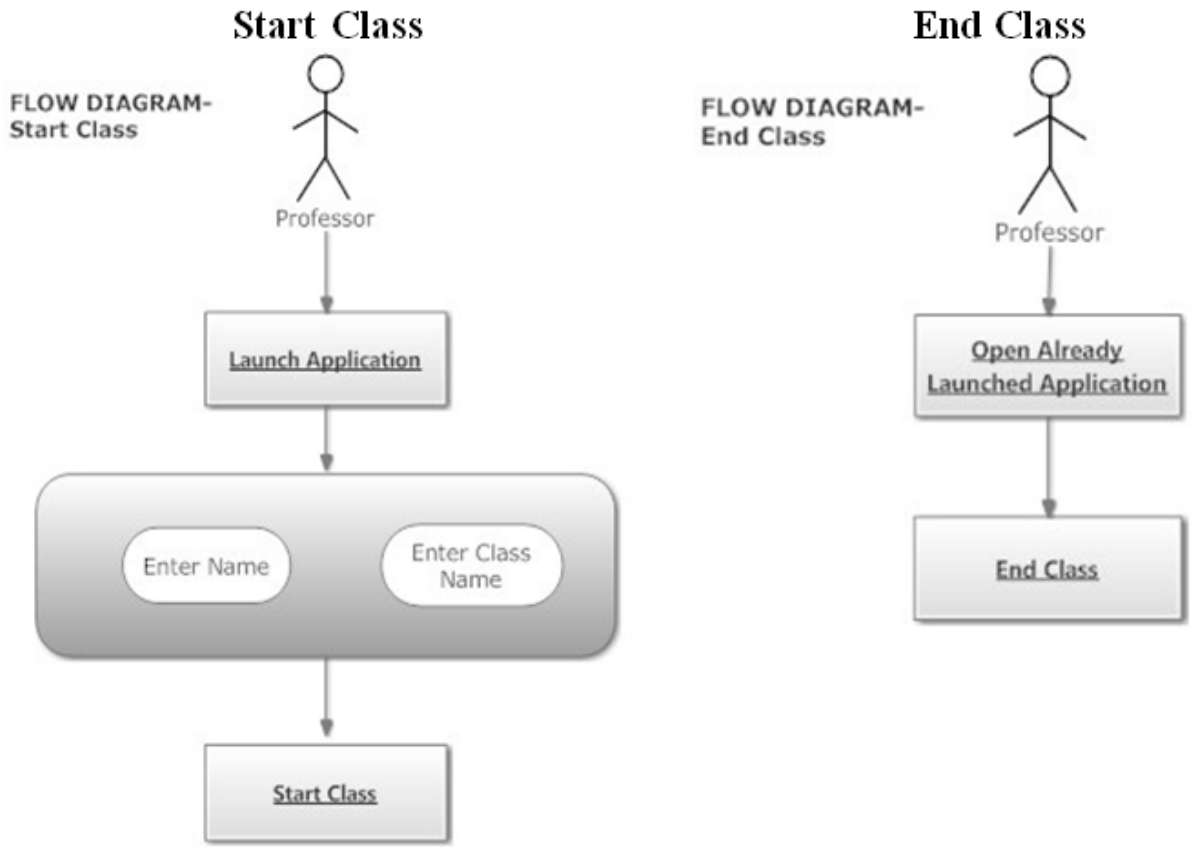


Figure 4.6. Start and end class - Use case diagram.

4.3.1.4 USE CASE IV (VIEW ARCHIVE)

The archived is open to general public. It has no restriction as the idea behind e-siksha was to make education and knowledge available to all. The user would have to go to e-siksha website and search for the class either by using the search tool or by accessing Archive directly as seen in Figure 4.8 and then look for the class.

4.3.2 Flow Chart

Flow chart is yet another way to access the system and to visualize how the process would move forward. I have the flow charts to explain the live class access methodology in Figure 4.9 and Access Archive methodology in Figure 4.10.

4.3.3 User Access Diagram

The diagram is to show what type of user would have access to what different components of e-siksha and what action can they perform on the components. It gives a

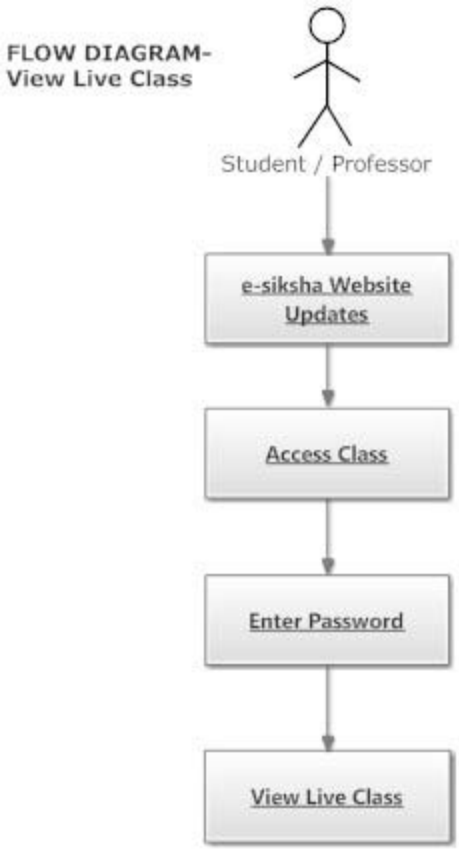


Figure 4.7. View live class - Use case diagram.

realistic approach towards the e-siksha system with which various access controls can be understood through Figure 4.11.

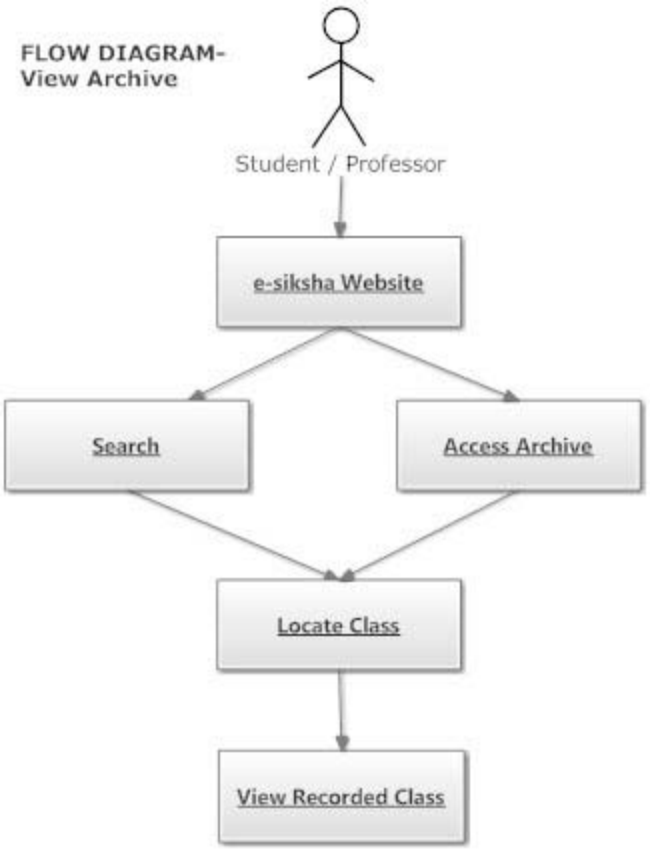


Figure 4.8. View archive - Use case diagram.

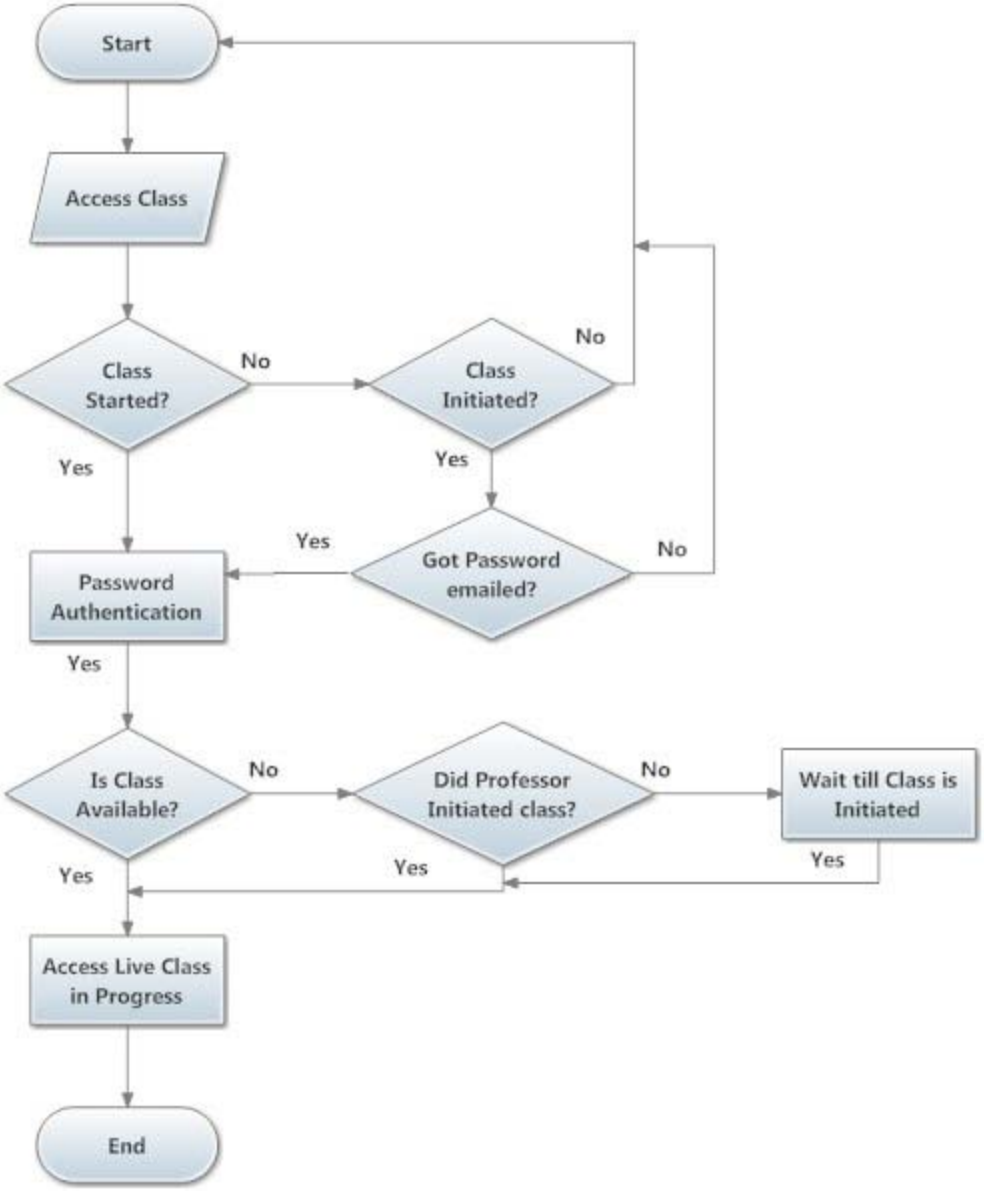


Figure 4.9. Live class access - Flowchart.

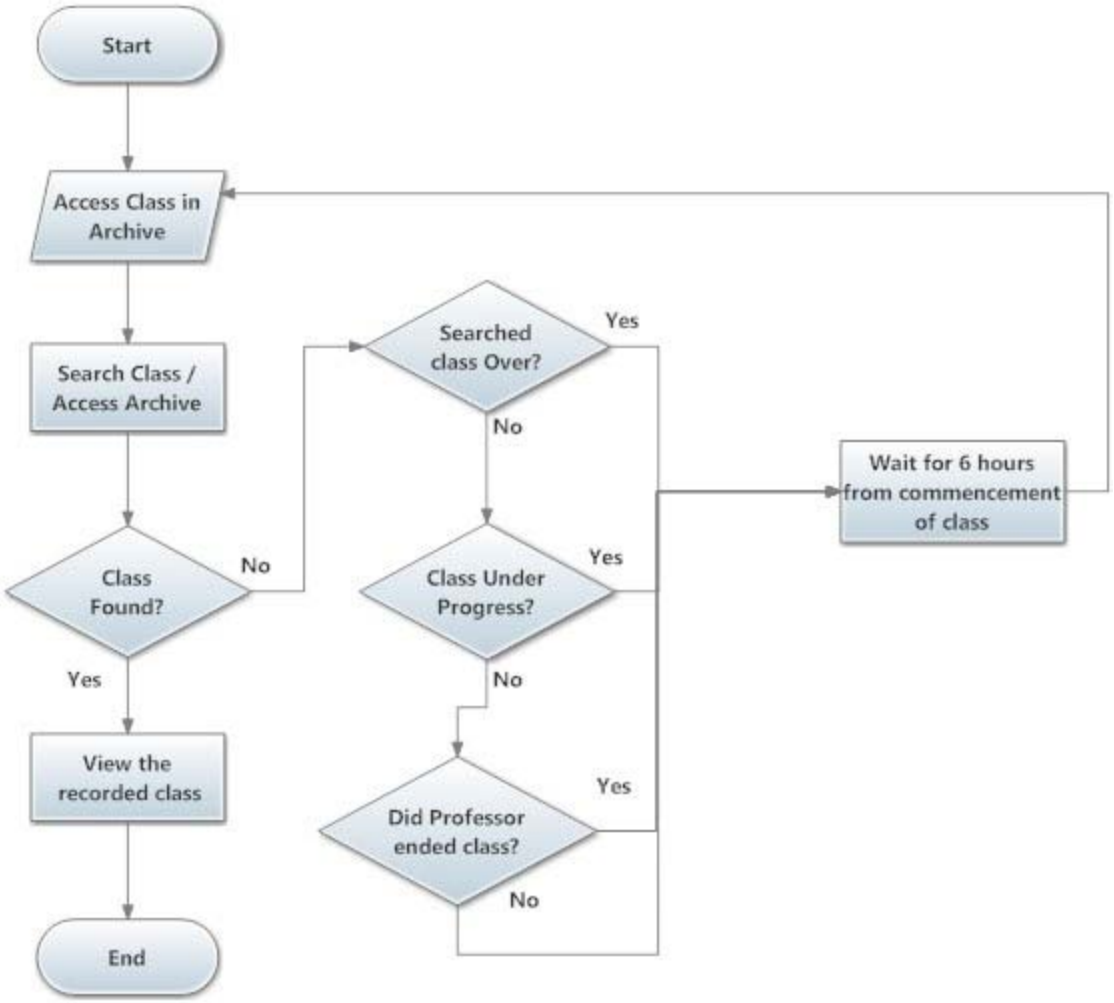


Figure 4.10. Access archive - Flowchart.

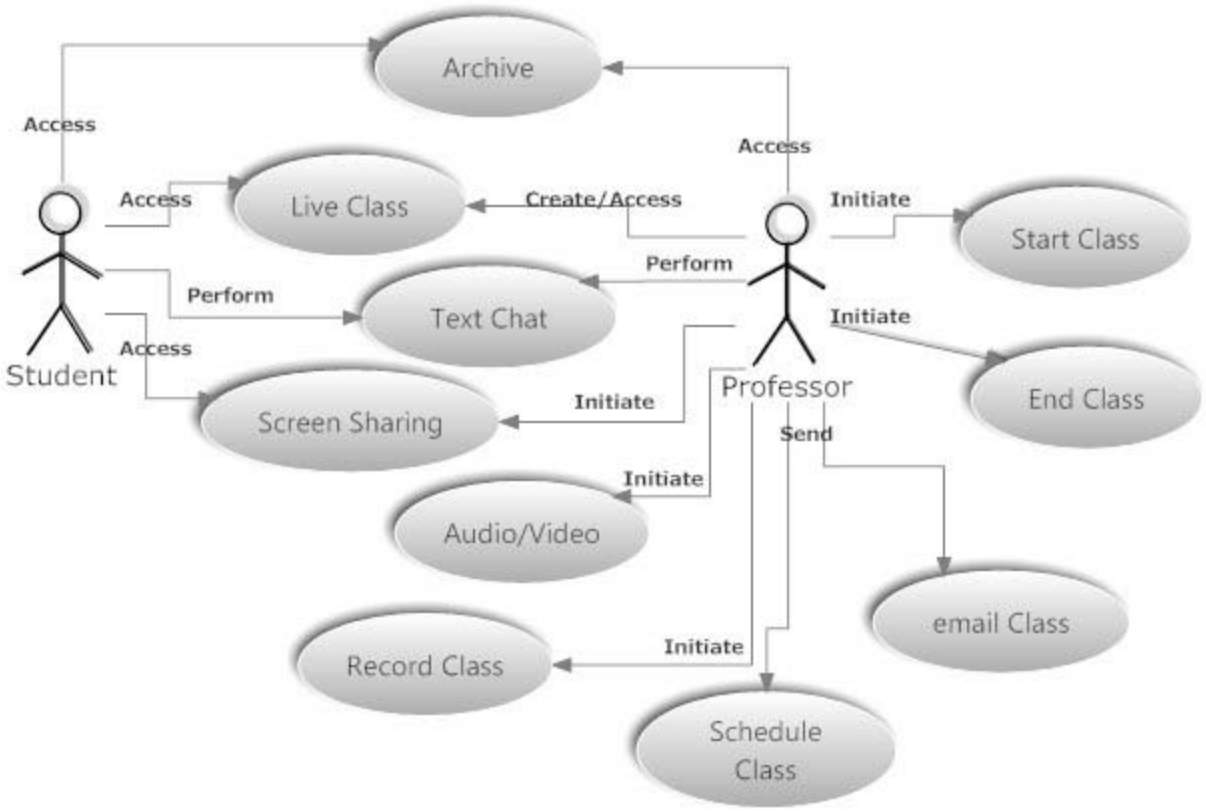


Figure 4.11. User access.

CHAPTER 5

USER INTERFACE AND FUNCTIONALITIES

5.1 THE PRESENTATION LAYER

As mentioned in chapter 4, the architecture of e-siksha is based on a 3-tier model – Presentation, Business and Data Layer. The Presentation layer is the top most layer, through which the user interacts with the application using the user interface.

The user interface is very essential for the application. The interface provides a lot of information about the application and thus a poor user interface would always lead to confusion. The presentation layer cropped from the architecture diagram from chapter 4, Figure 4.2 is present in Figure 5.1.

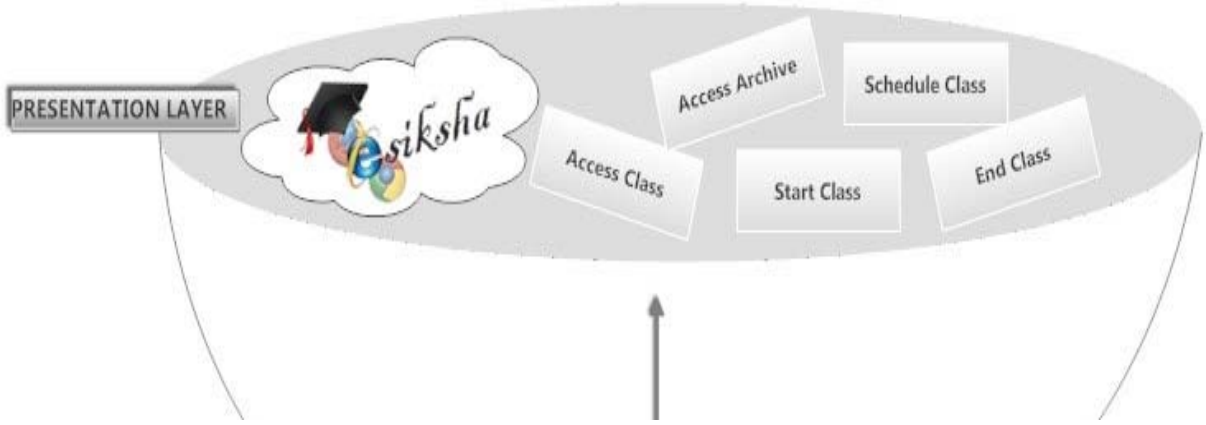


Figure 5.1. Presentation layer.

E-siksha has a number of user interface through which the user can interacts with the application (see Appendix A). The user interface for e-siksha is divided into following two chunks:

- E-siksha application: The e-siksha application is a desktop application developed in java. The application would only be used by professors to schedule a class or start/end a class. They can also use the application to update any information related to the upcoming class or any other message that they want the students should know through the 'update' tab.
- E-siksha blog: The e-siksha blog is open to public. Everyone have access to the blog. The students primarily would be using the blog for accessing the class, checking updates from professor, viewing earlier recorded session etc.

5.2 THE APPLICATION

As mentioned above in topic 5.1, the application is developed in java specifically for the professors. They would have complete control of the class with this tool. The tool is designed considering the fact that the professor holds a special power in the class. They can start any class and end it whenever they want. They can also issue various updates to the students through this application related to class. The message would be updated on the blog where students can see it. More details about the application would be discussed in topic 5.3. Before moving to UI, the system should be setup which includes running the server. The server setting and system settings can be found in Appendix B: System Setup.

5.2.1 Welcome

Figure 5.2 shows the first look of the application. As soon as the user (the professor) opens the application on their desktop, they would be on the welcome screen. The welcome screen provides information about e-siksha.

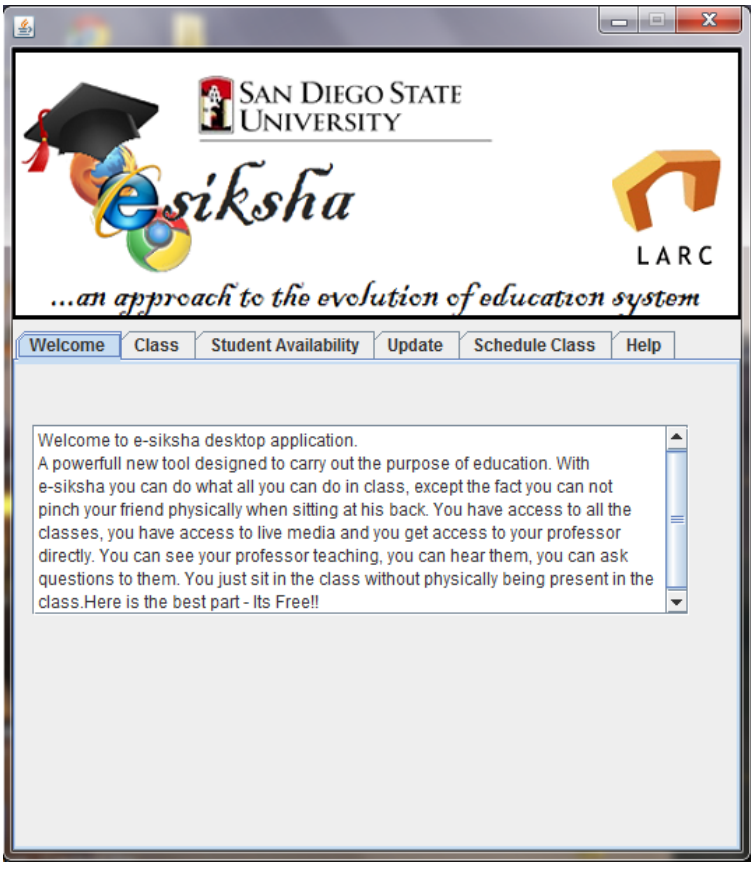

SAN DIEGO STATE UNIVERSITY
esiksha
LARC
...an approach to the evolution of education system
Welcome
Class
Student Availability
Update
Schedule Class
Help
Welcome to e-siksha desktop application.
A powerfull new tool designed to carry out the purpose of education. With e-siksha you can do what all you can do in class, except the fact you can not pinch your friend physically when sitting at his back. You have access to all the classes, you have access to live media and you get access to your professor directly. You can see your professor teaching, you can hear them, you can ask questions to them. You just sit in the class without physically being present in the class.Here is the best part - Its Free!!

Figure 5.2. Welcome screen.

5.2.2 Schedule Class

The next tab is the ‘schedule class’ tab. This tab gives the authority to the professor to schedule a class. The tab do requires some information prior to scheduling the class by the professor.

- Class name → Please enter the name of the class (FRNCH###, CS###, ECE##, etc.)
- ClassNameDateRediD → The field is provided to create a unique class id for the class. The actual name of the class along proposed date of scheduling the class all merged with the redid of the professor.
- Red ID → The Red Id asks the professor to enter their RedId. It is used to create a unique password which would be generated by applying a unique function on redit to create a password. This password would be hashed value of redid.
- Number → The field asks for any random number by professor to create a hash.
- Choose Mailer list → The button requires the professor to choose a text file which contains all the emails of the students, professor wants in their class. The professor would just need to have an updated notepad file, which would have email addresses of students so they can obtain the password, professor would be giving them to access the class.

Figures 5.3, 5.4, and 5.5 show the screenshot of the schedule class application.

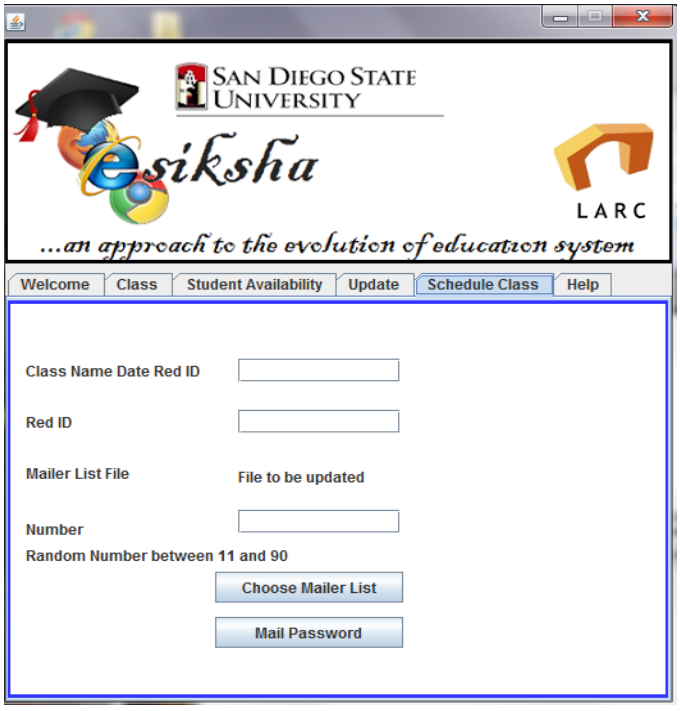


Figure 5.3. Schedule class tab.

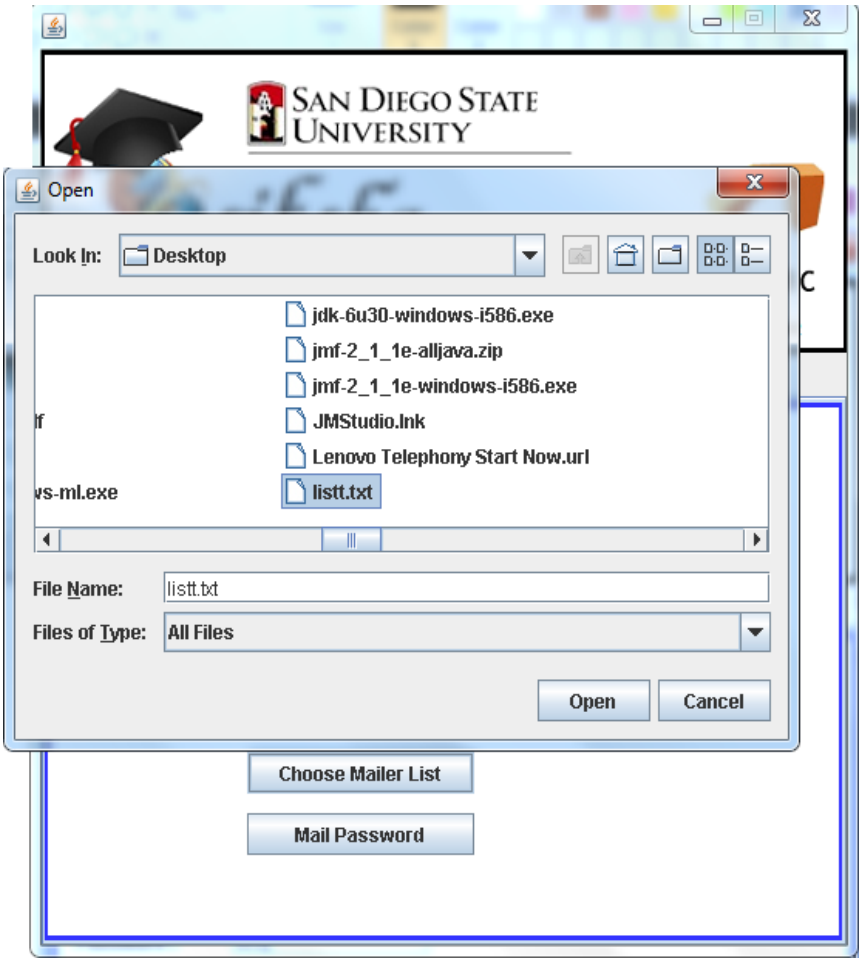


Figure 5.4. Choose mailing list in schedule class tab.

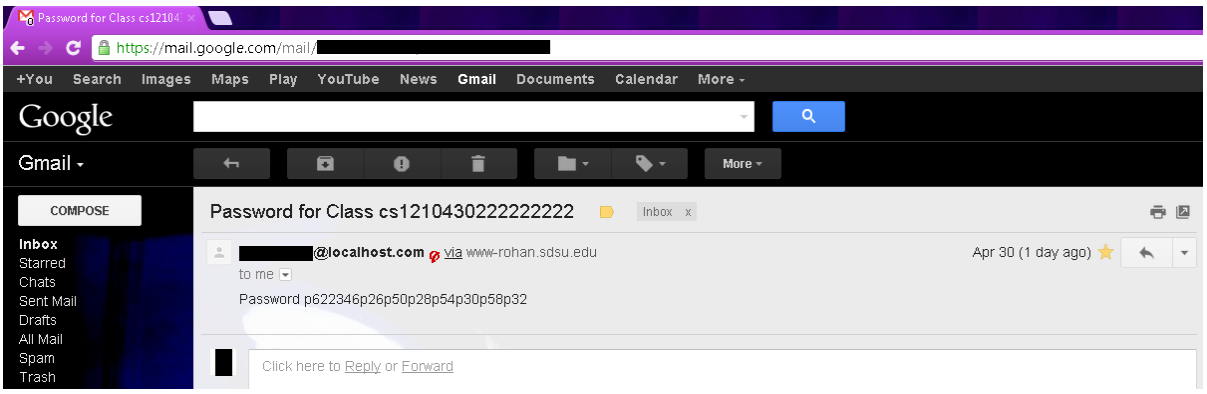


Figure 5.5. Email received by folks in mailer list.

5.2.3 Class

The Class tab is the tab which is to be used by the professor in order to either start the class or end the class. Before starting the class, the professor do have to provide some information, which would be needed in order to save the video file which would be generated in the end. The name of the video file would be based upon the information professor provides in the class tab. The Class Tab requires the following information:

- ClassNameDateRedId → The field is provided to create a unique class id for the class. The actual name of the class along proposed date of scheduling the class all merged with the redid of the professor enter the name of the class

The name of the video file which would be generated in the end would be in the format 'ClassName_Date'. This is the reason the date is asked in an integer format, which would always keep it distinguished from other classes and it will be easier to search on blog. Figure 5.6 shows the class tab from application in working stage.

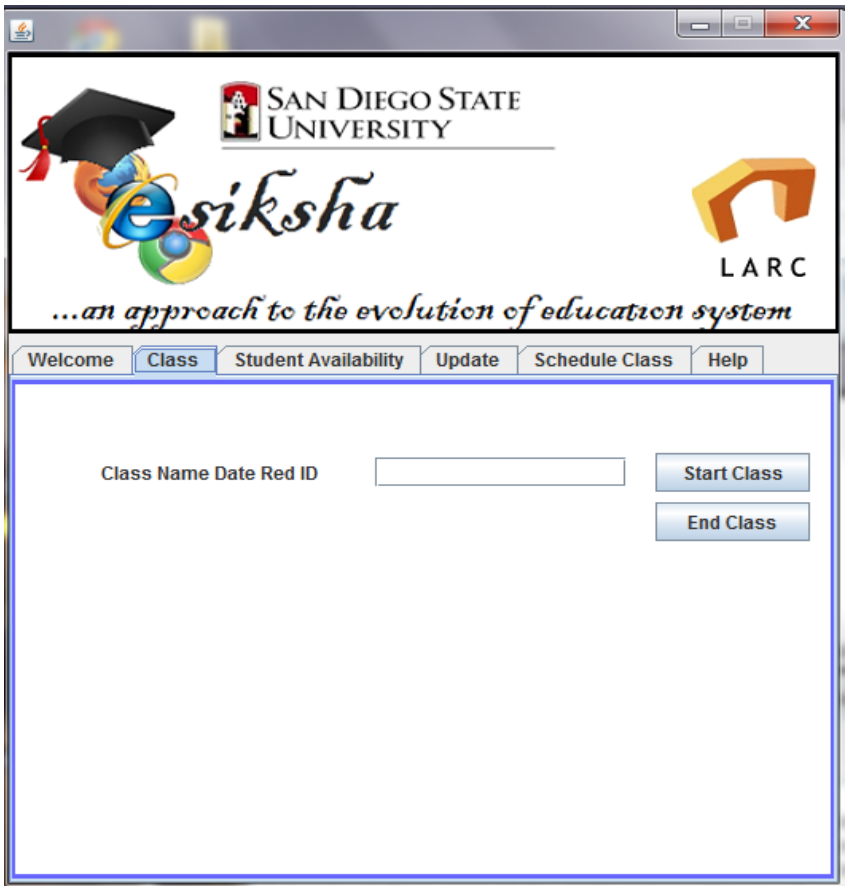


Figure 5.6. Class tab.

5.2.4 Update

The Update tab is the most use full tab for professors, who want's to send out an update regarding their class or any other message to their student. As in other tabs, Professor would have to provide some information here also in this tab and this information would be flashed on the home page of the blog so that students can gain the information quickly. The tab information panel includes:

- Professor Name → Since updates would be posted by many professors' using the system. The professor name is required which would act as a signature on the blog for the updated message.
- Last name → Last name is required specifically for the signature purpose and also to keep track in database.
- Update → The place is to provide the update message which would be flashed on the website or the blog of e-siksha.

Figure 5.7 shows the update tab.

Figure 5.7. Update tab.

5.2.5 Student Availability

The tab provides a privilege to the professor to get to know which students are currently accessing the class. The professor can anytime go to the tab and click the update button. The update button would run the scripts behind and provide the names of the student accessing the class in the adjacent text box.

Figure 5.8 shows the student availability tab in a working stage.

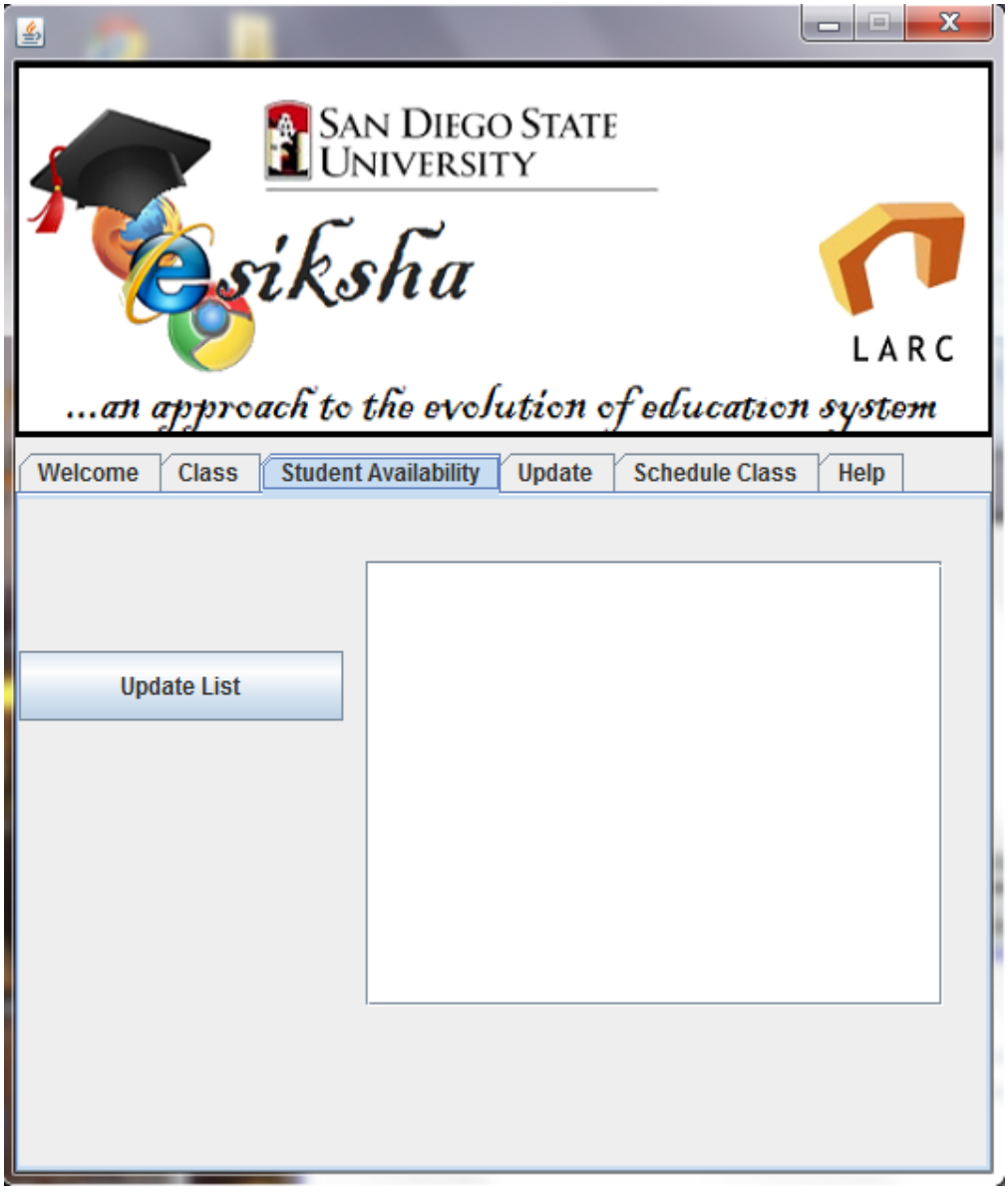


Figure 5.8. Student availability tab.

5.2.6 Help

The help tab is also placed in the application. The tab provides information related to the application and the data that is actually desired by the application for its smooth functionality. Figure 5.9 shows the help tab screen shot from the application.

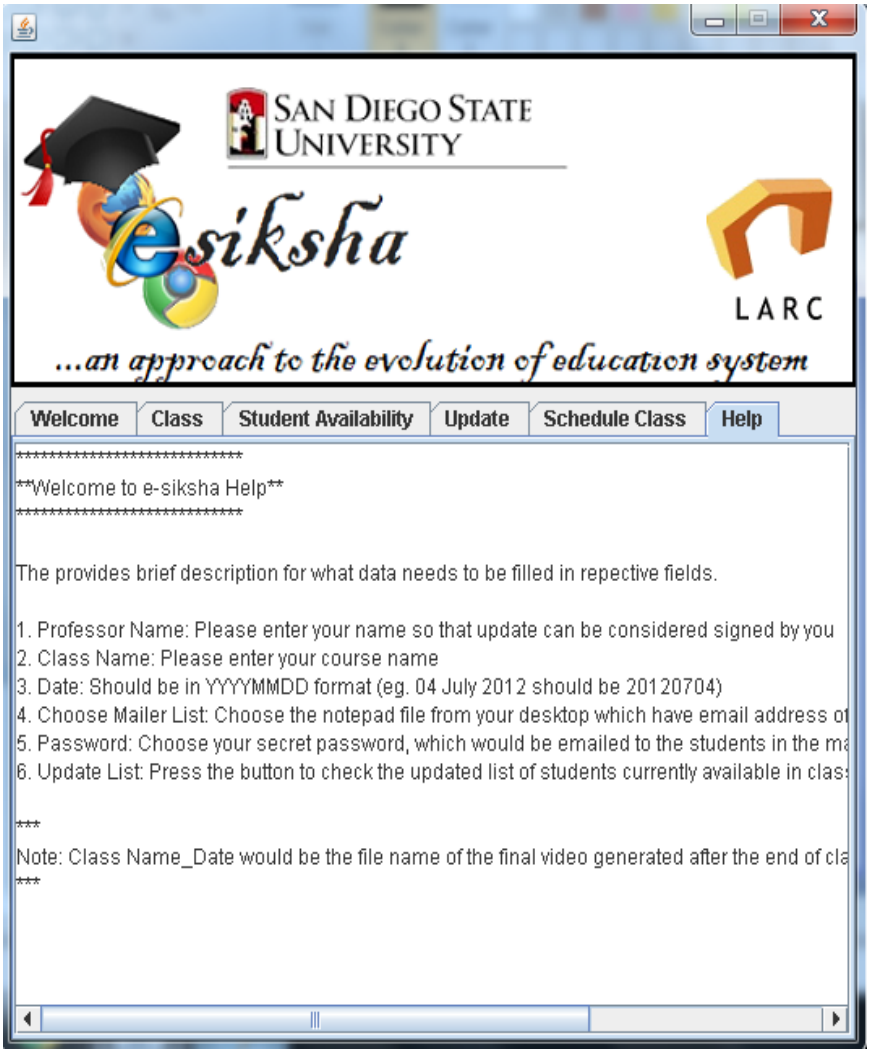

SAN DIEGO STATE UNIVERSITY
esiksha
LARC
...an approach to the evolution of education system
Welcome
Class
Student Availability
Update
Schedule Class
Help
****
Welcome to e-siksha Help
****
The provides brief description for what data needs to be filled in repective fields.
1. Professor Name: Please enter your name so that update can be considered signed by you
2. Class Name: Please enter your course name
3. Date: Should be in YYYYMMDD format (eg. 04 July 2012 should be 20120704)
4. Choose Mailer List: Choose the notepad file from your desktop which have email address of
5. Password: Choose your secret password, which would be emailed to the students in the ma
6. Update List: Press the button to check the updated list of students currently available in clas
***
Note: Class Name_Date would be the file name of the final video generated after the end of cla
***

Figure 5.9. Help tab.

5.3 THE BLOG

Compared to the desktop application, the students also have access to a user interface, which is the blog. The blog is an e-siksha website which shows all the saved videos. It acts a glass to archive. All the video files present in the database, are seen in the archive link. The students can get Updates from professor on the top right corner of the Home page. Students

will only have access to the blog. No registration is required as the motive behind e-siksha is to gain knowledge for free and in a hassle free route.

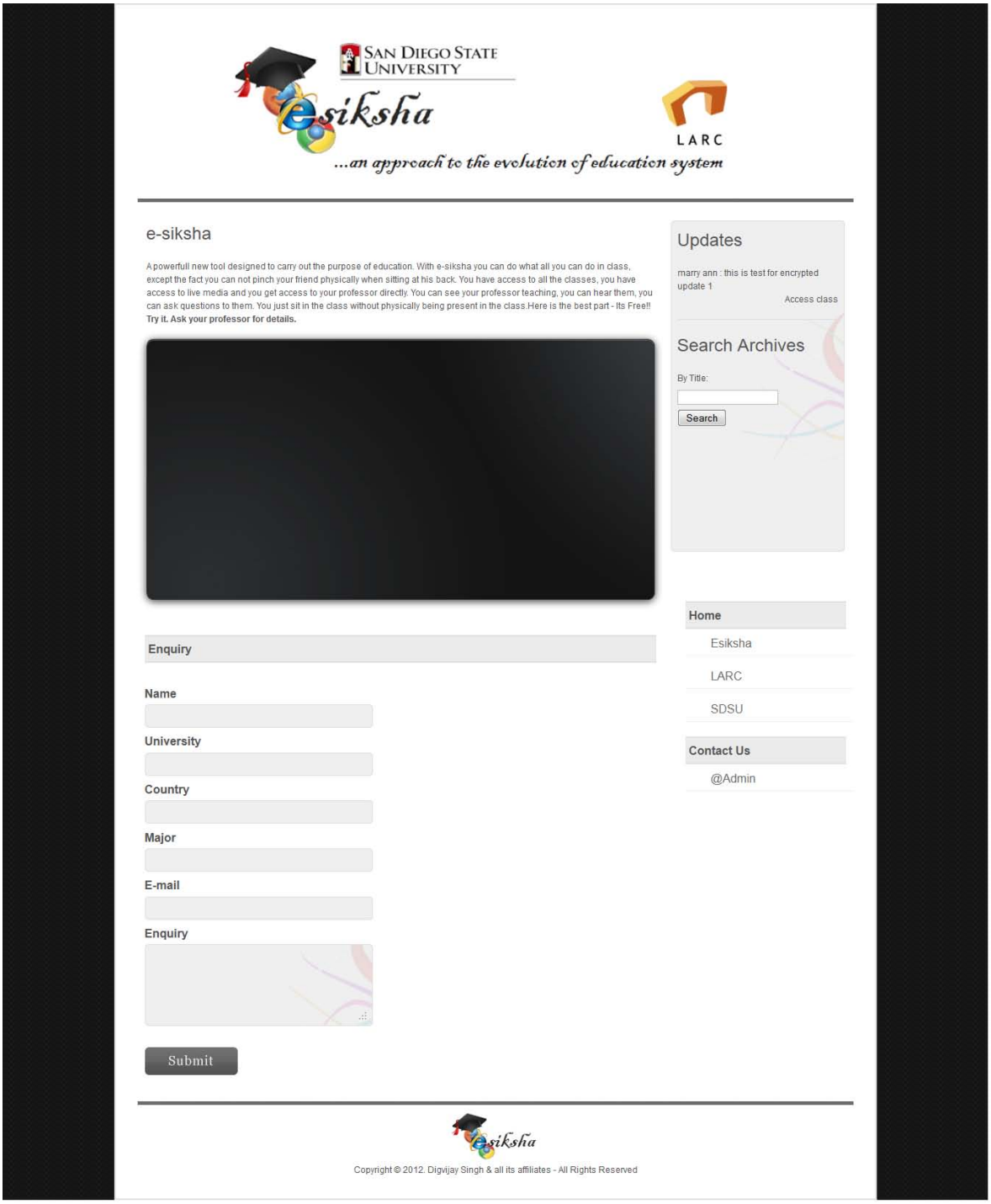
Some of the important features to look on the home page are:

- The video on the home screen shows a live demonstration of the application, from the point where professor schedules the class to the point where the video is uploaded.
- The Search archive tool search's the archive based on the name user provides or the date chosen. Any video related to the specification, would be shown in the search result.
- The Updates board on the top right corner is the update board. The Update board provides all the updates, the professor wants to provide to their students as discussed in the previous topic. The update board will keep the update rolling one-by-one for complete one week from the point, professor pushes the update in database.
- The Enquiry tab opens up and an enquiry form is present for student. The form will wrap all the content and send an email to the admin.
- The Other navigational links are present to quickly navigate to the corresponding website.
- Under the Update board, there is a link called 'Access Class'. The Access class link, when activated, asks for the password. This is the password which the professor sends through the application to the students. Only eligible students would be receiving the passwords in their email and thus would be able to access live class room.
- Once the correct password is provided, the student would be directed to a new page where the live class would be held. They would be able to see the shared screen by professor.
- The same pages also have the chat functionality available for students to communicate to the professor.
- The Archive link on the Home page is the quick access to the archives. As mentioned earlier, the archive is the place where all the pre recorded class sessions would be stored. The student would have access to all the classes present in database even though the student is not enrolled in class.

Figure 5.10 shows the home page of the e-siksha blog.

Figure 5.11 shows the page when search is used to search for a particular class from archive.

Figure 5.12 shows the page which gets generated when a live class is hosted.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...an approach to the evolution of education system
LARC
e-siksha
A powerfull new tool designed to carry out the purpose of education. With e-siksha you can do what all you can do in class, except the fact you can not pinch your friend physically when sitting at his back. You have access to all the classes, you have access to live media and you get access to your professor directly. You can see your professor teaching, you can hear them, you can ask questions to them. You just sit in the class without physically being present in the class.Here is the best part - Its Free!!
Try it. Ask your professor for details.
Updates
marry ann : this is test for encrypted update 1
Access class
Search Archives
By Title:
Search
Home
Esiksha
LARC
SDSU
Contact Us
@Admin
Enquiry
Name
University
Country
Major
E-mail
Enquiry
Submit
esiksha
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Figure 5.10. E-siksha blog – Home page.

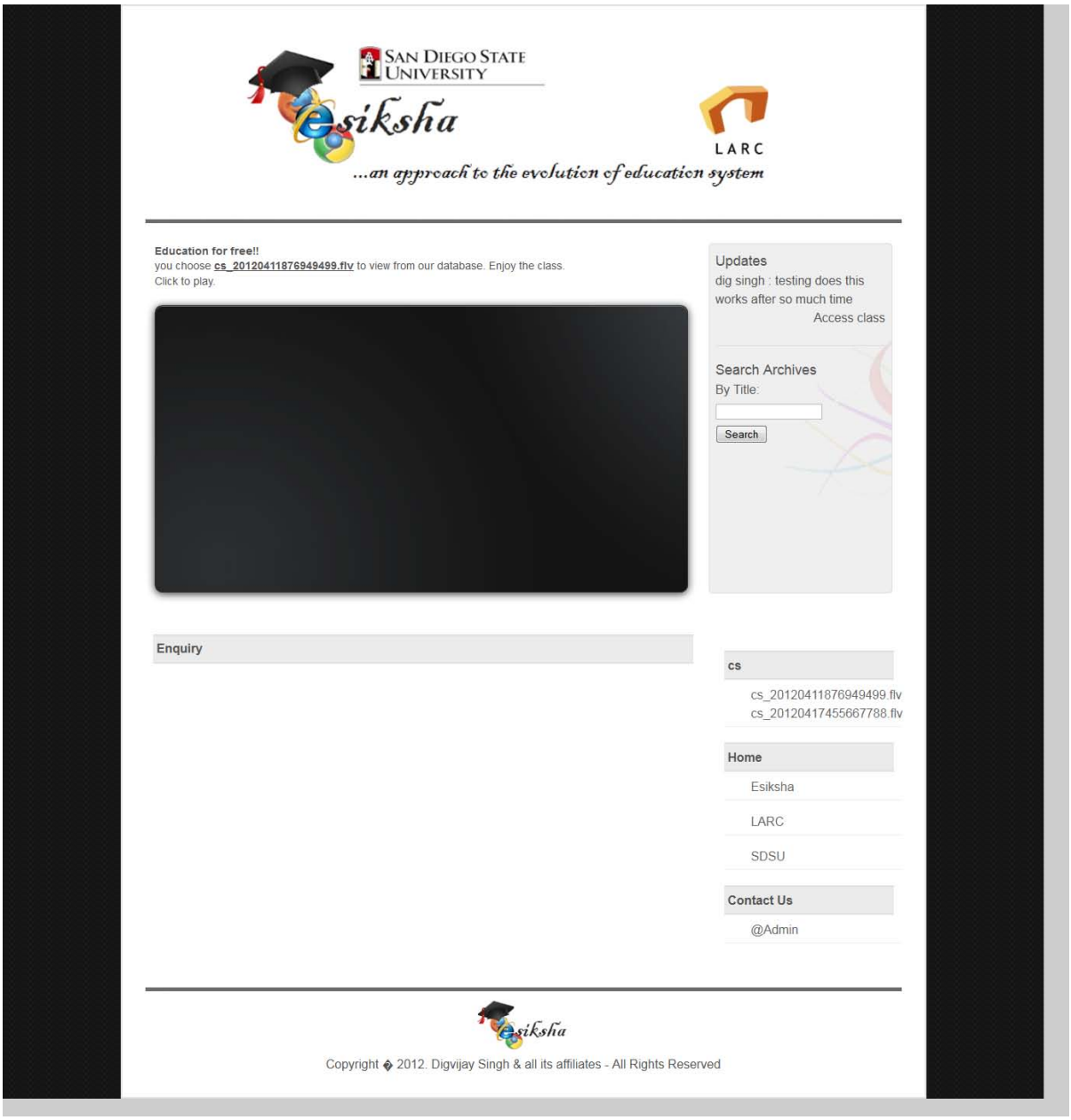

Figure 5.11. E-siksha blog – Search page.

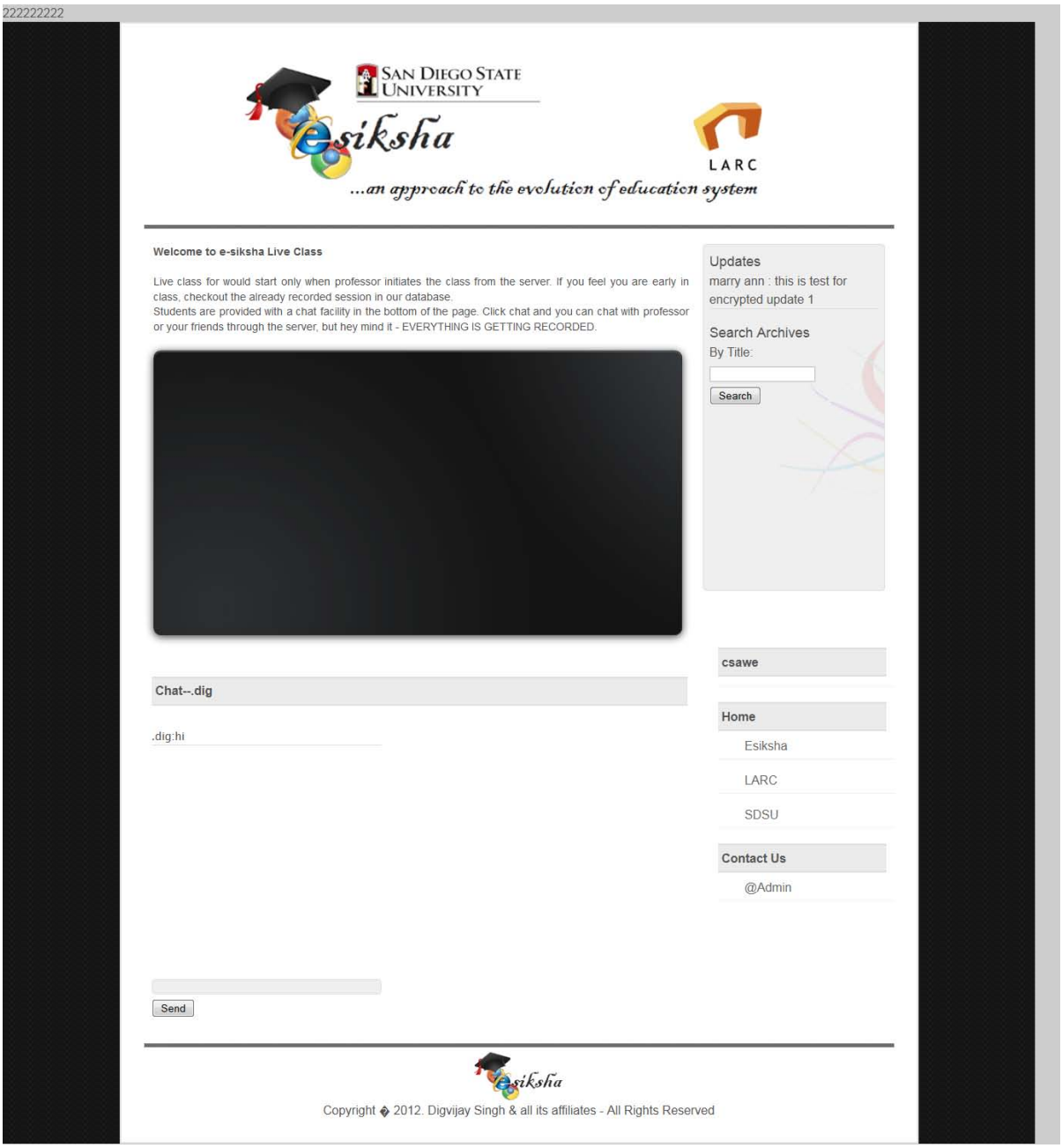
222222222
SAN DIEGO STATE UNIVERSITY
esiksha
...an approach to the evolution of education system
LARC
Welcome to e-siksha Live Class
Live class for would start only when professor initiates the class from the server. If you feel you are early in class, checkout the already recorded session in our database.
Students are provided with a chat facility in the bottom of the page. Click chat and you can chat with professor or your friends through the server, but hey mind it - EVERYTHING IS GETTING RECORDED.
Updates
marry ann : this is test for encrypted update 1
Search Archives
By Title:
Search
csawe
Chat--.dig
.dig:hi
Home
Esiksha
LARC
SDSU
Contact Us
@Admin
Send
esiksha
Copyright © 2012. Digvijay Singh & all its affiliates - All Rights Reserved

Figure 5.12. E-siksha blog – Live class.

5.4 ISSUES RAISED

Issues related to the initial implementation of the product were raised and some of the issues were critical in the security. They were resolved by the end of final implementation of the product. Some of the issues are:

- Security Issues: Issues related to the security of the database along with securing server were raised. The initial implementation of the product did not incorporate any

security measure and hence was developed solely for the purpose of implementation of a new product. The major security threatening technique which was raised during the review was SQL Injection.

The issues were resolved by implementing MD5 hash algorithm. Also a small change in architecture was done at a later stage which completely eliminated the risk of accessing information from database. The new architecture now asks the system administrator to manually put the university ID of the professor in the database. With this implementation, even if someone gains access to the application, they cannot use the application as their university ID is not present in database. Apart of this, the password which is generated is generated on the fly. The password which is sent to the student is not saved anywhere. The password is created by encrypting the University Id of the class host with a random number that would be chosen by the class host at the time of scheduling the class. On the viewer end, when student enters the password, the password is decrypted on the fly to create a University ID. This university ID is then matched with the University ID present in database. If they both match, the student would have access to live class else the application will not allow them to access live class.

- Unique Course/password Identification: In the earlier implementation, two professors were able to schedule a class with same name. when class is about to start, the application was initiating the class which was hosted first and all the students there after would be accessing the first class only even though they had password for the second class. The issue was resolved as a part of change in Architecture.
- Password Hash issue raised: With the new architecture, sometimes two different University ID even though when encrypted and hashed differently with different random numbers would produce same password. This issue was resolved.
- Chat message Issue: The Issue with chat message was that the first message of the chat was showing garbled message. The garbled message was coming up because encryption was applied on all fields. This issue was also resolved.
- Email flooding: Another issue was raised regarding email flooding when email was sent to students in email list while scheduling class with a little change in parameters. This issue was resolved.

CHAPTER 6

CONCLUSION AND FUTURE ENHANCEMENTS

6.1 CONCLUSION

As I mentioned in chapter1, the whole idea was to make sure that the education system have means with help of which the system can evolve. The Idea was to have a platform on which the education can be implanted and thus the core knowledge can be made available to everyone.

The thesis has proposed the idea to use the rapidly growing technology in such a way that it can dramatically amplify the knowledge platform and make it accessible to everyone. By providing a special website for this product, the students would have uninterrupted access to the classes they want. The special desktop application does not require any setup and is made specifically to be used by teachers to initiate the class by using simply their home or office computer and products they have installed.

The National Educational Technology Standards Projects (NETS) [25] defines technology integration with the following statement.

> Curriculum integration with the use of technology involves the infusion of technology as a tool to enhance the learning in a content area or multidisciplinary setting. Technology enables students to learn in ways not previously possible. Effective integration of technology is achieved when students are able to select technology tools to help them obtain information in a timely manner, analyze and synthesize the information, and present it professionally. The technology should become an integral part of how the classroom functions — as accessible as all other classroom tools. [26]

The application helps students, professors & people all around the world to have access to classes which are being held at the moment and learn something. The application helps students to gain access to class even after the class is over in order to make sure that their concepts are crystal clear. This is helping them to be 100% positive about the information they are having do not have any break points in it since they can later go back to the archives and attend the class. This product helps professors to take class sitting in their

office or in their home and side by side allow students also to be present in any part of the world and still gain access to the class.

Considering the application would be used by many students and many professors to pile up their lectures, the user interface and design of the application is designed considering every possible requirement needed when you are attending a class especially if you are attending it by not physically being present in the class.

6.2 FUTURE ENHANCEMENT

As I mentioned in the very first line of my thesis – Technology is growing rapidly and the proper use of it can bring miracles every second.

Since this is the Version 1.0 of e-siksha. The product does have a lot of features considering the capturing and presentation of a live class. Still there are many features which can be added to make it more robust, more useful and more powerful than it is right now. An endless number of enhancements can be made to e-siksha depending on what feature would be required and more importantly why is it required?

Some issues are still present in the system which needs to be fixed in order to deploy the current product. Some of those issues would be:

- Red Id Issue: The current product is accepting only nice digit numeric Red Id in password filed, which means it is only relevant for CSU professors. All other people who are not having a University in the above mentioned format would not be able to use it
- Update list text box issue: Any text in update text box is delimited by a comma. For large number of students, the list would be borderline unreadable.

Some of the most important enhancements which I think can be incorporated in e-siksha which would make it become one of the most popular tools on campus and outside would be:

- Improvement of latency in screen sharing
- Improvement in Audio/ Video tool
- Audio/Video availability for both Professor and student (Currently it is only available for professor to show and speak, the students can only listen and see, for any queries they have to use text chat feature)
- 100% Compatibility with mobile devices.

- Video editing features (like deleting a portion, etc.) on the cloud once they are stored, without downloading the video.
- Different database for different professor would help manage the video data more effectively and eventually faster results can be obtained

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APPENDIX A

USER MANUAL

This document is designed for teachers and professor to use the e-siksha application.

1. Class Tab

The class tab is the tab which will be used by user to start a class and stream it live. The tab has an input field box which takes the class name which will be streamed to students.
The format for class name is class name Date(MMYY) Red Id
Example: Class name: CS123, Date 05/07/2012 ,Red ID 123456789
The input box will have cs1230507123456789 as class name.

The use of Start class button is important as it starts live streaming of class.
The use of End class is important as it tells the application to stop to stream and
Upload the file to server for future reference.

Note: If the user ends the class with another method and not using End Class the video will not be available to user for future reference.

2. Student Availability

The student availability tab can only be used while the class is in progress.
The application requires the class name entered in the class tab into the class name date red id field so that it can bring the list of all students available for that class.
If the user fails to provide the detail the student availability cannot be used.
To get the list of students provide the class name as described in class tab and press update list button in student availability tab.

3. Update Tab

This tab requires the user to provide professor name, Last name and the update so that the application can post it to the web server and the update is displayed on the website top right corner.

4. Schedule Class

The tab requires the class name Date Red id as the class name that will be streamed live in future.
Requires the red id and a random number between 11 and 90 so as to generate a password.
Choose file selects a text file which has the email addresses of all intended audience for the live stream.

Not providing any of this data may cause the audience to not access live class.

5. Help

Carries short descriptive quick help for users.

How to schedule a class

1. Click schedule class tab.
2. Enter class name date red id as instructed in class tab.
3. Enter red id in red id field.
4. Enter a random number between 11 and 90.
5. Choose the text file having email id of end users.
6. Press Mail Password to generate mail and send class name and passwords.

How to start a class

1. User must enter the class name date red id as instructed in class tab.
2. Press Start Class.
3. To end class press End class.

How to check student availability

1. Enter the class name date red id in the field in class tab.
2. Go to Student Availability tab.
3. Press update list to get the list of students available.

How to post update

1. Enter professor name as first name.
2. Enter the last Name
3. Enter the update.
4. Click on Send Update to post the update live.

APPENDIX B

SYSTEM SETUP

Sever Environment Setup

1. The Red5 server requires **JAVA JRE 1.5 or 1.6**.
2. Set the **java class path** and **java_version** environment variable in the system pointing to the installed **1.5 or 1.6 jre java.exe**.
3. The red5 server requires port **5080** and **1935** for communication.
4. The admin must make sure these two ports are available.
5. Setup the **red_home** environment variable pointing to the root folder red5 in program files.

Media Server Setup:

1. Download red5 server from http://wiki.red5.org/wiki/1_0_RC1 the Zip format file.
2. Extract the zip into **C:\Profram Files** on 32 bit system or **C:\Program Files(X86)** for 64 bit systems and name the folder as Red5.
3. After extracting the zip in Red5 folder edit the **red5.bat** file on line 30 .
   The given code will be **"%JAVA_HOME/some_text"** and rename it to **"%JAVA_HOME"**.
4. At the end of file add pause command and save file.
5. Go to **conf** folder in the root Red5 folder.
6. Open and edit **red5.properties** and set IP on line **34,11** and **6**.
   The file carries IP **0.0.0.0** on the above said lines and set it to the **IP of server**.
7. Run the **red5.bat** in root **Red5** folder.
8. Open a browser window with flash support and type url as **server_ip_address:5080**
9. The page opens the home page for red5 server and click on **install a ready made application**. Install all the applications given on the page.
10. The server is ready to receive and transmit media.

Once the above said steps are complete the red5 server can be used to store and stream videos.

Web Server Setup

1. Install **XAMPP** package on the web server where the web service will be hosted.
2. The **XAMPP** automatically takes **localhost** as well as the server ip as its own reachable address.
3. Put the complete "**e**" folder and **passwordmailer.php** in the **htdocs** folder of XAMPP installation.
4. Edit the files **showold.php** and **showlive.php** inside folder **e** the following way.
   The following code is for **jwplayer** which streams the video from server, so in order to stream it should have the correct red5 media server address which we acquired while setting up the red5 media server previously. We need to edit the following code.

```
<script type="text/javascript">
 var flashvars = {

  file:\''.$_GET['video'].'\',
  streamer:\'rtmp://192.168.1.76/live/\'
 };
 swfobject.embedSWF(\'player.swf\',\'container\',\'630\',\'280\',\'9.0.115\',\'false\',
flashvars,

  {allowfullscreen:\'true\',allowscriptaccess:\'always\'},
  {id:\'jwplayer\',name:\'jwplayer\'}

 );
```

Replace the IP in **red color** with the IP of red5 server. In all of the above said files. The above code have different implementations on both files but we are only concerned with the IP we need to replace.

5. Till this point all the files are configured to stream media.
6. Now we need to setup the database for the chat,updates and other purpose.
7. The documents provided carry a file as **esiksha.sql** which will be imported into the **phpmyadmin** and it creates a **esiksha** database with four tables.
8. At this point the media server and the sql server are all ready to stream media and run the website.
9. The home page can be accessed at **webserver_address/e/home.php**

Application Setup

1. Open the project **screenshare** in **Netbeans IDE**.
2. To resolve the dependencies problem the developer needs to install **xuggle** from **xuggler.com.**
3. While the project opened in **Netbeans** right click on top node of **screenshare**. Click on properties. Go to library option. On the right click add jar. Go to red5 folder in **c:\program files** and import **red5.jar**. Also follow the same procedure and import all jars from the **lib** folder inside **red5** folder. Now repeat the same procedure for **xuggler**. Click on add jar and import all jars in **xuggler_directory/share/java/jars**.
4. By now all dependencies are resolved and the application has no errors for dependencies.
5. The application has two concerning files **CaptureThread.java** and **Sender.java**.
6. In **CaptureThread.java** on **line 139 and 141** replace the **IP** given with the **IP** of **red5 media server**.
7. In file **Sender.java** replace the **server="192.168.1.76"** with **server="the address of red5 media server"**.

8. Create a folder **esiksha** in **c:**.
9. In file **app.java** replace the **urlsendto** variable pointing to the new "**web_server/e/passwordmailer.php?**".
10. Replace **IP** on **line 510** with the new web server IP address.
11. Replace the **IP** on **line 493** with the new webserver address.
12. Build the application.

NOTE: Some computers might not have webcam facility and the webcam might not show up. But the application is designed to still capture the desktop and stream it live. Same issues can also be applied to sound capturing by the application**.**